SERIES 3—Vol. 2, No. 9 SEPTEMBER, 1919

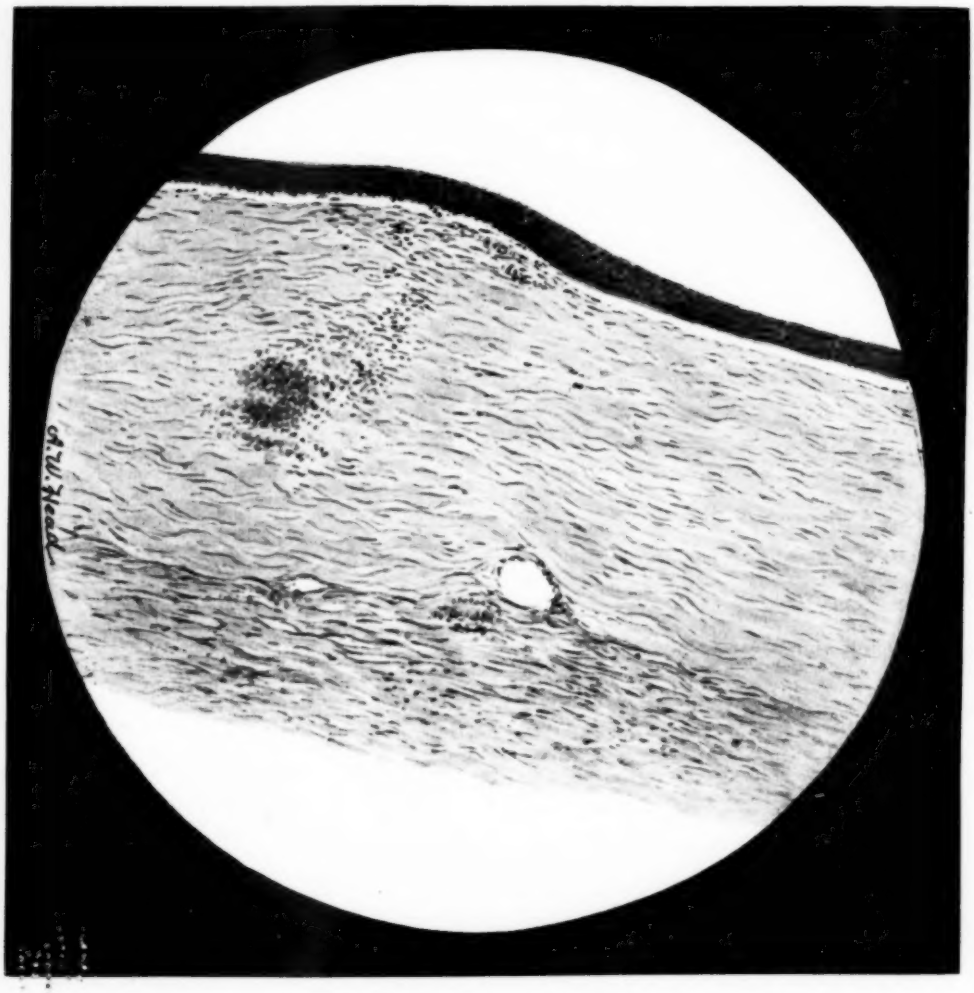
AMERICAN JOURNAL OF OPHTHALMOLOGY

Incorporating Established by
THE AMERICAN JOURNAL OF OPHTHALMOLOGY.....Adolf Alt 1884
THE OPHTHALMIC RECORD.....Giles C. Savage 1891
ANNALS of OPHTHALMOLOGY.....James Pleasant Parker 1892
ANALES DE OFTALMOLOGIA.....M. Uribe-Troncoso 1898
OPHTHALMOLOGY.....Harry V. Würdemann 1904
OPHTHALMIC YEAR BOOK AND LITERATURE..Edward Jackson 1904-11

Annual Subscription Ten Dollars in Advance,
Single Copies One Dollar.

PUBLISHED MONTHLY BY THE OPHTHALMIC PUBLISHING COMPANY,
7 West Madison Street, Chicago, Illinois.

Entered as Second Class Matter January 1st, 1918, at the Post Office, Chicago, Ill., under the act of March 3rd, 1879.



BLOOD STAINING OF THE CORNEA: X100
(MAGHY)

AMERICAN JOURNAL OF OPHTHALMOLOGY

Vol. 2 SEPTEMBER, 1919 No. 9

OBSERVATIONS OF BLOOD STAINING OF THE CORNEA.

CHARLES MAGHY, M. D.

LONDON, ENGLAND.

This report, from the Pathologist of the Royal London Ophthalmic Hospital, gives an account of four cases seen at that institution, and especially of the microscopic findings in three of the eyes, which required enucleation.

Blood-staining of the cornea was first described by Baumgarten[1] in 1883. It is a discoloration of the cornea resulting from the presence of blood cells in the anterior chamber, which in the majority of cases results from an injury, with or without penetration of the globe, altho it has been known to appear spontaneously after an intraocular hemorrhage in buphthalmos.

The time at which the phenomenon manifests itself clinically, varies from a few days to a few months—its duration may extend over months or even years.

It can be readily understood that it is a comparatively rare condition, when one considers the number of cases with eye injuries seen in ophthalmic practice. According to Römer[2] it occurred in one case out of 400 severe injuries at the Giessen Clinic. At the Moorfields' Clinic it has been observed in about the same proportion. Treacher Collins[3] saw 9 cases in 3 years.

There is some diversity of opinion as to what the coloring matter is and as to how it gains access to the cornea. Treacher Collins,[4] in his series of cases, considers the discoloration due to fluid passing thru Descemet's membrane by a process of diffusion and depositing hematoidin crystals in the corneal stroma, associated in some cases with hemosiderin. Weeks[5] is of the opinion that the pigment enters the cornea thru the spaces of Fontana in the soluble form of hemoglobin, and is there transformed into a salt insoluble in the fluids of the cornea. Vossius[6] thought there was direct hemorrhage into the corneal substance, the blood coming from the vessels at the limbus. Baumgarten regarded the refractile bodies, causing the discoloration, as microorganisms. Von Hippel[7] and Leber[8] as fibrin coagula. Römer as globulin masses—he at any rate, proved they were not fibrin by the use of Weigert's stain. Gutmann[9] showed they were not globulin by the fact that they were not acted upon by trypsin.

The refractile bodies are seen principally in the stroma. They vary in size and shape, but are usually rounded or oval. They average approximately 1.5 to 4 microns in diameter. They may be rod-shaped. With hematoxylin-eosin and Mallory's stain, they appear red. Van Gieson's stain gives them an orange color.

It has been demonstrated that hemoglobin is insoluble in water, alcohol, ether, xylol, chloroform, acetic acid, dilute mineral acids and weak alkalies.

Lyle,[10] Manual of Physiology, 1911, page 263, states, "Hematoidin forms flat lozenge-shaped crystals, and is found in the neighborhood of old blood clots, or hemorrhages which have occurred in the body, particularly in the brain or the lungs. It gives no absorption bands with the spectrum, and is iron free."

Case 1.—Morris D., aged 14 years. had the left eye needled four times at the London Hospital, the last being on May 12, 1908. In March, 1911, the eye became inflamed and painful, and on admission to Moorfields Hospital a

month later, the cornea was found to be hazy, the ciliary vessels injected, and the anterior chamber full of blood. Vision equaled light perception with faulty projection. Tension = minus 1. The eye was enucleated and on pathologic examination, the haziness of the cornea was found to be due to blood staining of the corneal stroma.

Case 2.—William C., aged 43 years. was admitted September 12, 1913, under Mr. Hepburn, with a history of having been struck in the left eye by a piece of iron the day previous. The cornea showed a penetrating injury with iris prolapsed. The anterior chamber was full of blood. Vision equaled hand movements. Tension, minus. The Haab magnet proved negative. The patient was discharged in December and attended the outpatient clinic at regular intervals, vision now being 2/60. The hyphema had become absorbed and a small hypopyon occupied its place. On the 24th of December of the same year a fresh hyphema appeared and the tension became plus 1. January 23, 1914, the cornea showed extensive blood staining. The vision was reduced to fingers and the eye was very painful. The pain continued in spite of treatment and the eye was enucleated on February 7th, 1914. Right eye is normal. Vision equals 6/6.

Pathologic Report.—A healed scar is present in the center of the cornea. Bowman's membrane is intact and normal. The stroma shows dark, small, yellow granules, which are rounded and oval for the most part. These granules lie upon the fibers and between the corneal spaces. Descemet's membrane is not invaded. The anterior chamber contains laminated connective tissue, which is vascularized. Pigment cells are scattered about in this connective tissue. The iris shows atrophic changes and lies in contact with the cornea at places. The lens is forward. Choroid normal. The retina is not very atrophic. Optic nerve is cupped.

Case 3.—Emily H., aged 10 years, was admitted to Moorfields Hospital, January 2, 1915, under Mr. Hepburn, with a penetrating injury at the temporal side of the limbus of her right eye, the result of a blow with a stick. On admission vitreous was in the wound and the anterior chamber was full of blood. Tension, minus. Vision reduced to hand movements. A conjunctival flap was stitched over the wound and some vitreous escaped during the operation. On the 16th of January it was first noted that the cornea was blood stained. The hyphema was now disappearing, but no details were yet visible of the deeper structures. The eye became painful and was enucleated on February 2nd, 1915. L. eye normal. Vision equaled 6/6.

Pathologic Report.—Only the cornea was embedded. The epithelium is edematous. Bowman's membrane contains fine granules. These granules are coarse and predominate in the anterior part of the stroma. Some are rod-shaped but the majority are rounded and oval. Posteriorly, the granules are dustlike. The endothelial cells on the posterior surface show vacuolation opposite the area that is blood stained. The granules take the eosin stain.

Case 4.—Thomas D., aged 33 years, gunner, 65th R. G. A. Regiment, was in a gas attack for several hours on September 5th, 1918, from which time his eye trouble dates. He was treated at a base hospital in France after the attack with lotion and drops until October 8th, when he was sent to England. On October 10th he was admitted to Moorfields Hospital under Mr. Spicer. Examination at this time showed a burn of the conjunctiva below the cornea with marked conjunctival and ciliary injection. In the substance of the cornea was an area that was dark red in color, measuring about 6 mm. in diameter and occupying the lower and central part. Vision equaled light perception with faulty projection. Tension, minus. Not very painful. Right eye enucleated October 15th, 1918. Left normal, V. = 6/6.

Pathologic Report.—Macroscopic—The globe measures about 23.5 by 23 by 23 mm. The entire cornea is hazy and tends to bulge forward. A me-

ridianal section shows the iris to be adherent to the posterior surface of the cornea. Blood clot in anterior chamber. Lens in situ. An exudate fills the vitreous. The retina is not detached. Optic nerve looks normal.

After staining the sections with hematoxylin-eosin and Mallory's stain, the cornea was reembedded and paraffin sections cut.

Microscopic—At the limbus corneae are seen many degenerated blood cells. The cornea is about normal in diameter. In contour it tends to form an anterior staphyloma. The epithelial layers are regular and enclose a mass of blood cells near the periphery. Thruout the stroma are seen areas of blood corpuscles. Small, dark colored, refractile bodies are also present, measuring about 2 microns in diameter on the average. These bodies are rounded and oval and take the eosin stain. Bowman's membrane and the rest of the cornea show nothing pathologic. The iris at the periphery is adherent to the posterior corneal surface. A few small hemorrhages are present in the iris stroma. The vessels are filled with blood. The pigment epithelium on the post-surface is uneven and in many places heaped into clumps. No atrophy or cell infiltration. The ciliary body shows the pigment epithelium covering the processes to be undergoing atrophic changes. The vitreous contains a mass of faintly staining cells and debris, the individual cells being difficult to describe on account of degenerative changes. The retina is not very atrophic and is not cystic anteriorly. The optic nerve is not cupped. Left eye normal. Vision 6/6.

In case 4, I dissolved the paraffin from the sections with xylol and placed them in the dark for ten days in undiluted peroxid without, however, affecting the refractile bodies.

CONCLUSIONS.

1. The highly refractile bodies seen in the corneal stroma in cases of blood-staining of the cornea are pigment granules transformed from hemoglobin.

2. Hemoglobin gains access to the cornea by diffusion thru Descemet's membrane.

3. The discoloration is due principally to the pigment granules altho blood corpuscles may be associated as shown by the plate. The degree of the discoloration varies according to whether hemosiderin or other hemoglobin derivatives are present.

4. The staining never affects the extreme periphery on account of the efficient lymph circulation at the limbus, nor do we find pigment granules in this area.

5. The presence of an iron reaction seems to depend on the vascularization of the tissue.

REFERENCES.

1. Baumgarten. Ueber eine eigenthümliche, auf Einlagerung pilzahlicher Gebilde beruhende Hornhautveränderung nebst experimentellen Untersuchungen zür Entstehungs und Mykosenlehre. Arch. f. Ophth., Bd XXIX. 3, p. 117. 1883.
2. Römer. Die Durchblutung der Hornhaut. Samml. zwanglos. Abhandl. aus. d. Gebiete d. Augenheilk. Bd. 11, p. 8.
3. Collins. Discoloration of the Cornea with Blood Pigment. Trans. of the Ophthal. Society of the United Kingdom. Vol. XV, p. 69.
4. Collins. Two cases of Staining of the Cornea by Blood Pigment. Trans. of the Ophthal. Society of the United Kingdom. Vol. XI, p. 43.
5. Weeks. Peculiar Pigmentation of the Cornea. New York Eye and Ear Infirmary Reports, p. 37.
6. Vossius. Ueber die eigentühmliche Grünliche Verfärbung der Cornea nach Traumen und ihre Beziehung zu Cornealblutung. Arch. f. Ophth. Bd. XXXV 2, p. 207.
7. Von Hippel. Ueber Hydropthalmus Congenitus nebst Bemerkungen ueber die Verfärbung der Cornea durch Blutfarbstoff. Archiv. f. Ophth. Bd. XLIV 3, p. 558.
8. Leber. Notiz über das Vorkommen von Fibringerinnunger in Gewebe der Hornhaut. Archiv. f. Ophth. Bd. XXXV 1, p. 271. Bd. XXXV 2, p. 250.
9. Gutmann. Ueber Durchblutung der Hornhaut. Centralbl. f. pract. Augenheilk. p. 43, 1909.

10. Lyle. Manual of Physiology. 1911, page 263.
11. Griffith. Blood-staining of the Cornea. Trans. of the Ophthal. Society of the United Kingdom. Vol. XIV. p. 74. Vol. XV, p. 86.
12. Halliburton. A Textbook of Chemical Physiology and Pathology, p. 293.
13. Hirschberg. Die Durchblutung der Hornhaut. Centralbl. f. prakt. Augenheilk, p. 177, 1896.
14. Lawford. Coloring Matter, Blood-pigment in Cornea. Trans. of the Ophth. Society of the United Kingdom. Vol. XIV, p. 74. Vol. VIII, p. 60.
15. Scheffels. Ein Fall von Durchblutung der Hornhaut. Zeitschr. f. Augenh. Ed. V., p. 277.
16. Schmidt. Ueber die Verwandschaft der hematogenen and autochtonen Pigmente und deren Stellung zum Hemasiderin. Archiv. f. path. Anat. u. Phys. u. f. klin. Medicin. Bd. 115. Heft 3, p. 397, '89.

THE X-RAY TREATMENT OF RETINAL GLIOMA.

DR. KANAME KUSAMA, I. J. A. M. C.

TOKYO, JAPAN.

This paper reports three cases of glioma of the retina treated with X-rays and radium. In each case the ocular growth was checked, and the eyeball became shrunken; but metastases occurred causing death. The autopsy findings with microscopic examination in one case include a metastasis to the pancreas.

The fact that in a boy suffering from glioma of both eyes and subjected to X-ray treatment, the tumor-tissue had considerably shrunk after several exposures, was reported at length by Professor Komoto and myself at the General Congress of the Japanese Ophthalmological Society, in April, 1917. Since then, two other similar cases have been treated in the same way, but with radium radiations added to insure success. After one year, in all these three cases, a contraction of both eyeballs was witnessed, together with the shrinking of the gliomas.

Axenfeld has expressed himself on this point thus: "The action of radiotherapy is an elective one. It destroys the tumor but leaves the normal tissue undisturbed, as far as can be determined clinically." Altho our cases went on to phthisis bulbi, we were led to imagine at least that we could save the lives of the patients; and so we reported the cases, and continued the treatment.

But, during 1918, all three boy patients met with similar lamentable catastrophes. One began to suffer from meningitis, the second developed metastatic nodules thruout his body, and both these cases terminated in death. The third patient was attacked with metastatic tumors in the parietal region, and he too, died. Altho we were not wholly without fear of some such fatal result, our attention was focused upon the contraction of the eyeballs and involution of the primary tumors, so that, exulting in the local destructive power of the Roentgen rays and hoping to save lives of the patients we did not anticipate the eventful development of the metastatic tumors. The fact that phthisis bulbi may result from the use of X-rays has not yet been recorded by any authority.

This being the case, we hasten to report on the sad outcome as a corrective to our former too hopeful report. As a preliminary let us first of all sketch briefly the pathologic history of each case.

CASE 1. A. H. aged one year and two months; both eyes suffering from retinal glioma in the second stage. Consulted us for the first time on September 12, 1916. Both eyes apparently sound externally, but on examination the pupils somewhat dilated; yellowish white tumor mass, on the surface of which retinal blood-vessels are visible; intraocular tension increased; altogether exhibiting the aspect of the amaurotic "cat's eye."

At first X-rays alone were applied, and shrinking of the tumors was observed; but exposure to the rays produced an erythema with edema at times. Therefore, after April, 1917, the frequency of the exposures to the X-rays was lessened and radium (0.99 gr.) was applied to each eye twice a week.

On the 8th of November, 1917, the eyelids were thickened, the eyelashes had all fallen out, and the conjunctiva was injected. The cornea was hazy, the aqueous humor had a reddish hemorrhagic appearance, the pupils and iris were obscure, the intraocular tension reduced. The eyeballs were contracted into the condition of phthisis bulbi, and sunk deep in the sockets. X-rays applied up to that date amounted to 486 H. (Holzknecht's units), while radium had been applied to each eye for one hour, in all 40 times.

This state of things continued to the end of January, 1918, when the patient was found sick, nauseated, and emaciated.

February 2, 1918. We took away a small quantity of clear spinal fluid by means of lumbar puncture.

February 7. Lumbar puncture again; but vomiting did not cease, and he died on February 18th.

The total duration of the treatment was one year and seven months. Exposures to X-rays, 93; quantity 645 .5 H; to right eye, 617 H., and to left eye, 584 .5 H.

The method of application of the X-rays was as follows: From the front on each eye 5-10 minutes every time, focus-skin distance 20 cm., hardness of tube 4-7 W., thickness of the aluminum filter 1.5-30 mm., thus total dose of X-rays 5-8 H. every time.

SUMMARY:—In this case all the eyelids were inflamed from exposure to the X-rays, and the eyelashes fell out. The cornea became hazy, the anterior chamber hemorrhagic. Phthisis bulbi developed. Finally after eighteen months from the beginning of the treatment the patient died with symptoms of meningitis.

Fig. 1. Case 2, after ten months X-ray treatment, eyeballs contracted and sunken, lid margins macerated. Metastatic nodes in forchead. Right parotid region swollen.

CASE 2. Y. K., a girl, 6 months old; retinal glioma of both eyes. First consulted us April 14, 1917. According to her mother, the child began to see with one eye only about September 1916. About January, 1917, she presented a "cat's eye" reflex from her right eye. From about February, 1917, her left eye showed a similar reflex. On examination both eyes exhibited the typical aspect of the amaurotic "cat's eye." Pupils somewhat dilated.

White uneven tumor-mass seen thru the pupil, bloodvessels running over the tumor mass; intraocular tension rather lowered.

X-rays and radium rays applied together.

June 15, eyelids became thickened; eyelashes fell out; conjunctiva injected. The tumor-tissue in the eye broken up, course of blood-vessels obscured.

July 14. External aspects the same, parenchyma of the cornea generally hazy. Both eyeballs somewhat phthisical.

August 29. Haziness of the right cornea increased; iris and pupil altogether obscured; the left eye appeared red, from bleeding in anterior chamber.

November 8. General aspects almost the same, the phthisis bulbi more marked.

X-rays applied to each eye, in all 30 times, to the total of 464 H.—Radium rays applied to each eye 30 times for one hour each time.

January 16, 1918. Right parotid region showed an elastic nodule about the size of a dove's egg, movable with the skin.

February 16. On the right forehead a chestnut-sized nodule was noticed, about the hardness of cartilage, movable with the skin. The nodule in the parotid region gradually enlarged covering the region of the cheek forward, extending over the cervical region backward, and stretching the skin.

February 18. A subcutaneous nodule was discovered in the right temporal region about the size of a dove's egg.

February 25. X-rays were applied to the above mentioned nodules. The tumors in the right parotid region shrank considerably, and nodules in the right temporal region disappeared; but the hard nodule on the right forehead grew larger and larger, reaching about the size of a bantam hen's egg. (Fig. 1.)

March 2. The application of X-rays to the nodules on the face was continued, and the hard one on the right frontal region almost disappeared, while the tumors in the right parotid region shrank to the size of a hen's egg. But two hard nodules were found in the inguinal region about the size of a finger tip and several hard nodules were felt under the abdominal wall from the size of an ordinary bean to that of a horse bean.

March 8. Both eyeballs greatly shrunken; eyelids inflamed from X-ray burns. Appetite lost, debility increasing. The patient died on the 12th of March after a night of delirium.

Her treatment continued for eleven months. X-rays were applied to each eye 46 times; for the right eye 296.5 H., and for the left eye 311.5 H. To the nodules in the right parotid region 10 times, 120 H., to those in the abdominal region, once, 8 H.

The method of application of X-rays to the eyeballs was the same as in the preceding case.

SUMMARY:—In this case, the eyelids were inflamed from the use of the X-rays, and the eyelashes fell out. The cornea became hazy, the anterior chamber hemorrhage. Phthisis bulbi developed as in the preceding case. But in the present case, metastatic tumors broke out in the frontal right temporal and right parotid regions, under the abdominal wall, and in the inguinal region. The patient died debilitated.

CASE 3. M. I., aged 5 months. Retinal glioma of both eyes in the second stage. January 28, 1916, consulted for the first time. Good physique and nutrition. But both eyes exhibited an appearance of "cat's eye." Pupils dilated. Intraocular pressure raised. In each eye, three large tumors are observed in contact with each other in the vitreous humor. In the right eye there were two large tumors, one above the other, and between them a nebulous tumor mass intervened. In the left eye, three similar tumors were in contact with one another by their margins, one being situated above the other with the third at their side. In both eyes, the blood vessels on the surface of these tumors ran as in healthy retinas.

February 23. Exposures to X-rays, three times, quantity 16 H. in all. Intraocular pressure somewhat lowered; retinal glioma considerably disintegrated, even to transparency, and

nebulous tumor-mass greatly shrunken. Retinal glioma in left eye also somewhat shrunken.

May 23. Of the tumors in the right eye, the upper one and side one were all greatly shrunken and unless examined in the dark room, could not be made out; and only the lowest one remained. The big tumors one above another in the left eye, tended toward transparency, and their tumor-tissue appeared to be destroyed.

April 24, 1917. From this date radium (0.99 gr.) as well as the X-rays was applied once or twice a week for one hour.

November 8, 1917. The eyelids of both eyes thickened somewhat, eyelashes all fallen out. Eyelids, conjunctiva, and iris all congested. Around the pupil, on the iris margin, an irregular pigment ring had formed, presenting an ectropion of the pigment layer at the iris margin. Beyond the pupil, yellow tumor tissue was visible in the vitreous humor. The eyeball tended toward phthisical shrinking.

November 15, 1917. In the right eye, on the surface of the cornea, a blood vessel 1.5 mm. in diameter, is seen running up and in.

November 20. Around the blood vessels running obliquely on the surface of the right cornea, a parenchymatous haze was perceived.

December 8. The blood vessel running obliquely on the surface of the right cornea has already changed into a white line; and the infiltration round the blood vessel has become more extensive, causing parenchymatous haze, so that the anterior chamber and iris are completely obscured.

February 2, 1918. The middle of the right cornea gradually degenerated and shriveled, so that its tissue was broken, and perforated, to discharge a yellow mucoid matter. The left eye remained in the state of phthisis bulbi.

February 20. The perforation of the right cornea closed by the growth of surrounding tissue; but the cornea showed the signs of phthisis corneae.

February 25. The right eye gradually protruded, remaining in a shriveled condition. The eyelids and skin were tense and painful, and the debility being more and more marked, the right eyeball was enucleated.

March 9. In the right parietal region a hard nodule was felt about the size of a sparrow egg, and the debility increased. Both eyelids showed red spots from burning by X-rays, and the lid margins were greatly macerated.

March 30. The tumors in the parietal region had gradually enlarged to the size of a dove's egg.

April 14, 1918. The patient died.

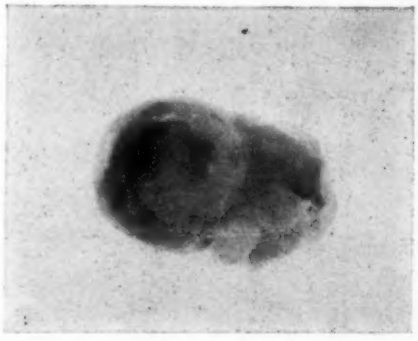


Fig. 2. Röntgenogram; enucleated eye from Case 3. Extension tumor continuous with globe has broken through the sclera posteriorly. Calcified lens and vitreous cause dark shadow.

The method of application of the Roentgen rays was the same as in the two preceding cases.

Inspection of Enucleated Eyeball:—The eyeball was in a shriveled condition, but had a white tumor mass of equal size attached to it, the whole measuring 30 mm. in length, and 20 mm. in breadth. The whole cornea was hazy, with a depression in the center, the edges of which were tinged with yellow.

Skiagraph of Enucleated Eyeball:—During section of the enucleated eyeball for pathologic study, the microtome knife grated on something. Suspecting a calcareous change we took a radiograph. In the region of the lens, a dense oval shadow is visible, while in the back part of the vitreous humor, one or two small dense shadows can be seen. (Fig. 2.)

Pathologic Study of Enucleated Eyeball:—The celloidin was dissolved away, the eyeball was thoroly decalcified by means of a 5 per cent solution of nitric

acid, the eye again embedded in celloidin, and serial sections made.

The cornea is perforated in the middle, the edges of the perforation being considerably thickened, and is much infiltrated by round cells. The sclera is generally thickened, and at the horizontal plane in the middle of the eyeball, the thickest part reaches 2 mm.

The tissue of the eyeball is generally loose and rarified especially in the part in contact with the tumors that remain attached to the back part of the eyeball. Here, in two or three places, perforations tissue, three times as thick as the sclera.

The retina is wholly replaced by the tumor tissue.

The calcified crystalline lens has lost its form in the process of calcification, while the vitreous humor is filled with tumor tissue, with the exception of empty spaces in the decalcified structure. The tumor tissue within the eyeball is loose, rich in blood vessels, hemorrhagic at the center and here and there degenerated.

The tumor tissue at the back of the eyeball is very compact, being formed of densely packed round cells with scarcely

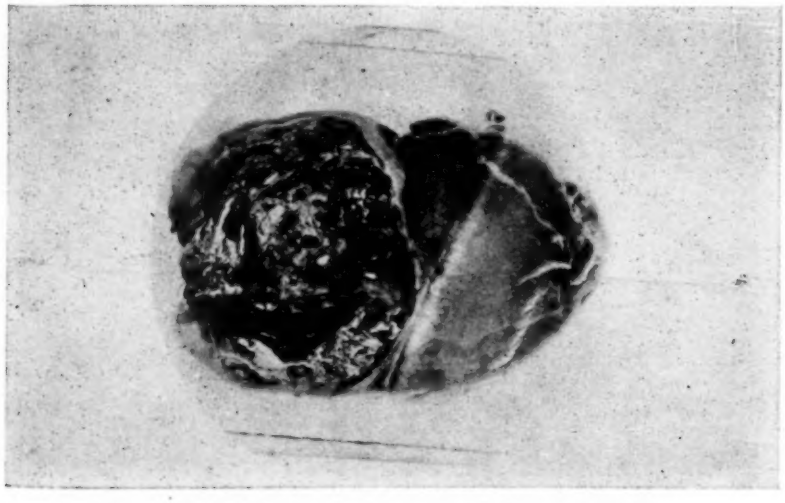


Fig. 3. Magnified photograph of enucleated eyeball, section.

exist; these being occupied by tumor tissue which connects the tumors within the eyeball with the tumor tissue behind the eyeball. That is, the tumors within the ball, perforating the sclera, have formed a large metastatic tumor mass beyond the ball.

The iris is thickened and infiltrated with round cells, and a part of it is in intimate relation with the perforated region above described. The ciliary body is generally loose and rarified, and is swollen. The choroid is detached from the sclera on the nasal side, and the space between them is filled up with a considerable amount of exudate staining red with eosin. Behind the equator of the eyeball the choroidal tissue is infiltrated thruout with loose tumor visible protoplasmic substance; almost no trace of the fibrous tissue is discernible there. Tho rich in blood vessels, and having degenerated spots, as in the tumor tissue within the eyeball, it shows no hemorrhagic center, thus resembling sarcoma.

This patient was, with the consent of his father, brought to autopsy, which revealed metastatic tumors in the bones of the cranium, the dura mater, the liver itself and the pancreas.

The report on the autopsy will be given later.

SUMMARY:—The retinal glioma in both eyes was greatly reduced in size by exposure to the X-rays; but this treatment produced such complications as the reddening and thickening of the eyelids,

maceration of the margins of the eyelids, falling out of the eyelashes, perforation of the cornea, and shrinking of both of the eyeballs. Metastasis of the glioma to the cranium, dura mater, liver and pancreas led to the patient's death after treatment for two years and three months. The right eyeball proptosed by the metastatic tumors in the orbit, was enucleated and the crystalline lens was found to be undergoing calcification.

General Considerations.

The three cases treated with X-rays and radium, all were suffering from retinal glioma in its second stage.

In consequence of the application to them of X-rays and radium, the tumors themselves shrank, but at the same time the eyeballs underwent a similar change. One patient developed signs of meningitis, the second had metastatic tumors in the frontal and temporal regions, and the third (the autopsied one), had similar metastatic tumors in his cranium, as well as the internal organs, and all three cases terminated in death. The shrinking of the tumors in the eyes took place in a striking manner after a few exposures to the X-rays, but the phthisis bulbi took at the shortest 7 months, and at the longest two years. From the time in which the phthisis bulbi was first noticed until death occurred the course was rather rapid, from three to five months only. From the discovery of the metastatic tumors to the time of death the interval was very short; in the second case, 2 months, and in the third case only 1 month. The interval between the commencement of treatment and death was, the shortest 11 months, and the longest 2 years.

According to our experience, our mode of application of the X-rays could not prevent the growth of metastatic tumors. The X-rays, vigorously used, would destroy the tissue of all morbid tumors; but, if weak, might on the contrary stimulate the growth of such tumors.

If, with retinal glioma in both eyes, one eye only be thus vigorously treated, the other eye remaining untouched, may not the malignancy of the untreated tumor become enhanced by more rapid extension along the optic nerve, thru the sclera, or by general metastasis?

Axenfeld had a patient whose one eye had already been enucleated and to whose remaining eye, in which three small retinal gliomas were found, he applied the X-rays. On this patient Axenfeld reported three times. The first report[1] says: He began to treat the patient in 1914, and treatment continued for months; the quantity of X-rays applied being 3,385 Kienboeck units. The tumors shrank considerably and the sight was partially recovered. The second report[2] says: In January, 1915, 8 months after the first report, the smallest of the tumors was almost wholly absorbed, only leaving a grayish green spot on the retina. The middle-sized tumor below the macula lutea, also, was almost absorbed, while a white streak formerly present disappeared, leaving only a grayish white haze. The biggest of the tumors was not yet absorbed, tho considerably shrunken. Thruout the normal tissue, no disturbance was observed and the patient was mentally and physically sound. As to X-ray treatment, he goes a step further to say: "In all events, we wish to recommend that in future cases the amaurotic eye be not X-rayed, but enucleated, for the avoidance of diagnostic errors, in order to free the body of the prolific metastasis in the most logical manner. In beginning glioma to prevent a similar growth in the other eye, or to prevent later stages and recurrences in the event of improper use of the X-rays, the therapy may be used."

His third report was a paper delivered before the Ophthalmological Society in Heidelberg, which M. Patry has summarized in the Annales d'Oculistique[3] as follows: "The subsidence of the tumor, due to radiotherapy, continued. In the fall of 1915 a cataract developed. The patient, a child of 3 years, was operated upon in the spring of 1916; this was attended by a return of vision. For six months a state analogous to blindness by blepharospasm was produced, but the child actually saw. Will this improvement last? The child is normally developed both intellectually and physically. The still-

growing lens had not been able to withstand the strong rays. But this is not a contraindication to the treatment. Radiotherapy is not preferable to enucleation, except in the second eye and when vision is not too greatly diminished."

In short, Axenfeld does not unconditionally approve the application of the X-rays to the treatment of retinal glioma. He says only: "When the visual power has not yet greatly diminished, or when the enucleation is refused; or in cases of later stages or relapse, its application is proper and justified.

But in his third report, Axenfeld, it seems, says nothing about the largest tumor, which had not been absorbed at the time of his second report. The great world war has prevented us from hearing from him for a long time. So the prognosis at least must be deemed still uncertain. In other words, his observation is not completed.

At any rate he asserted that two of his three tumors had been completely absorbed. Let us compare our cases with his. Was his success in the application of the X-rays due to the fact that his patient was in the first stage, and the tumor tissue very rudimentary? Or to the circumstance that his patient had had one eye already enucleated, and he had only to do with the remaining eye? Then let us consider that in our cases the patients were in the second stage, and the tumor tissue considerably developed, besides being dual; so that, tho on one side the rays acted destructively, on the other side they must have worked constructively, to help on the growth of metastatic tumor tissues. In our cases, might it not have been better and more effective if we had applied the rays simultaneously to both eyes, by means of a large, hard tube and a very thick filter; or to both eyes simultaneously but separately each from the temporal side, by means of two tubes?

Now I desire to state my conclusions with respect to the X-ray therapy based wholly on my personal experience.

Conclusions.

1. The X-rays should only be applied when retinal glioma is bilateral and the parents of the patient refuse to have one eye enucleated. In such cases the rays should be applied to both eyes jointly or severally by means of a big tube or two tubes both from the front as well as from the temporal regions.

2. After enucleation of the eyeball, when retinal glioma is unilateral, the X-rays may with great advantage be applied in order to prevent recurrence of the glioma.

3. Against retinal glioma in the last stage, or a relapse, the X-rays can prevent the local growth of the tumor; but it is impossible to save the patient's life by preventing the growth of metastatic tumors.

4. Axenfeld's statement, "After the enucleation of one eyeball, if a retinal glioma be found in the remaining eye, and that be in the first stage, and the visual power be perfect, exposure to X-rays may be tried with good results," cannot be accepted as established, until the final report is made on his patient's three tumors. For while one of them still remained unabsorbed, who can say that it would not undergo a metastasis in the future?

5. The tube employed in applying the X-rays should be very hard, and the filter must be very thick.

The Effect of Roentgen Rays on Human Eyes.

We employed a very thick aluminum filter (1.5—3. mm. thick), in applying the X-rays, but the frequency of application finally induced the thickening and reddening of the eyelids, maceration of the lid margins, falling out of the eyelashes, haziness and necrosis of the cornea, phthisis bulbi, and calcification of the crystalline lens.

Some of these have already been noticed by other observers before; thus Chalupecky[4] applied the rays to his patient for 24 hours (16 times in 27 days) and produced haziness of the cornea, and burning of his eyeballs. Birch-Hirschfeld[5] perceived, after 42 days, degeneration of the corneal surface and

transformation of the cells of the optic nerves; and Triboudeau and Lafargue[6] observed inflammation and ulceration of the conjunctiva and cornea, and also the inflammation of the iris. But no one has yet recorded, as we now do, phthisis bulbi and calcification of the crystalline lens. This may be owing to the fact that their experiments did not continue so long as ours; the quantity of X-rays they used was much less than ours. Our prolonged treatments, and the great quantity of rays employed, no doubt afforded us this opportunity.

There remains one more interesting problem. That is the effect of X-rays upon the growing eye. Triboudeau and Belley[7] conducted a comparative experiment on a new-born rabbit and a mature rabbit, and found that in the former the X-rays interfered with the growth of the iris pigment, induced cataract formation, moreover the eyeballs became stunted, and the retina formed folds or wrinkles.

Von Hippel[8] applied X-rays to the abdomen of a pregnant rabbit, and the new-born offspring all suffered from congenital cataract. In Axenfeld's third report we see a similar effect on his child patient. It is plain that the X-rays exert a deleterious influence on the crystalline lens of the growing eye. Thus we are justified in inferring that the phthisis bulbi and calcification of the lens observed by us were chiefly due to the fact that our patients were very young and in the growing period, and further to the cumulative action of

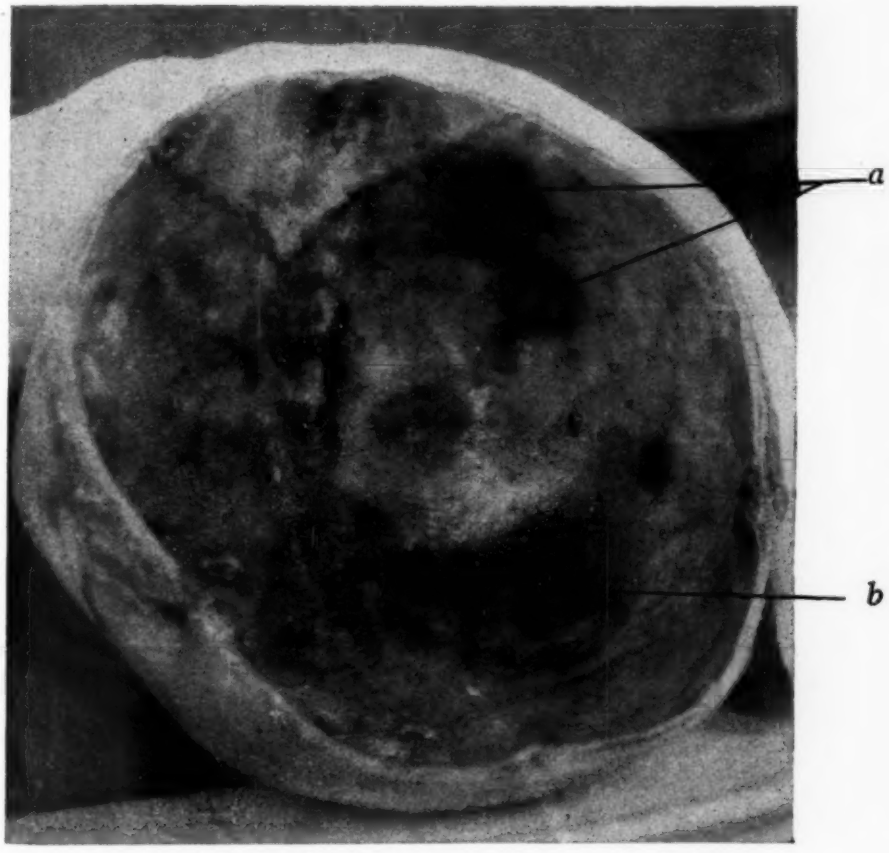


Fig. 4. Interior of cranium, Case 3. Small metastatic tumors, (a) the largest, (b) breaking thru the bony wall.

the rays. Axenfeld added this remark at the end of his paper: "We regard our observations as only a single foundation stone for the whole question." We are glad that we too are able to contribute two or three stones to the foundation of this important problem.

enucleation, a large quantity of radium (from 50 to 125 mgms.), was applied in order to prevent a recurrence of the tumor, no sign of which was observable after eighteen months.

The second case was one in which a recurrence was observed in the orbital

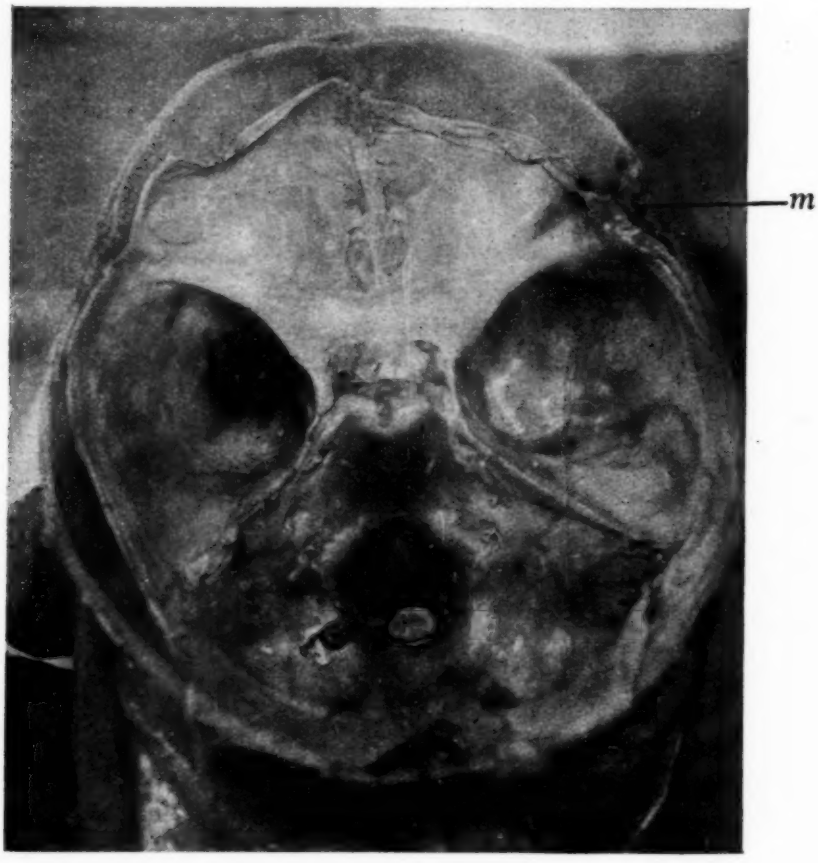


Fig. 5. Base of skull with dura mater; deep red metastatic tumors (m) between cranium and dura in temporal region.

Sincerest thanks are offered to Prof. Komoto, who kindly placed these important cases at my disposal. I offer also my warmest thanks to Dr. Iwazaki, the head of our X-ray department, who ably managed the application of the rays.

[After I finished writing this article, I saw a report of three cases of retinal glioma to which radium was applied by Dr. Rex Duncan.[9]

The first case was one in which, after

cavity 5 months after enucleation; but the recurrent tumor shrunk considerably three weeks after the application of 110 mgms. of radium.

The third and last case was one in which, after enucleation, a small recurrent tumor was noticed in the central part of the orbit, a little to the nasal side; and after application of a tube containing 50 to 110 mgms. of radium, the tumor was speedily absorbed.

From this Dr. Duncan concludes that a retinal glioma may be cured without recurrence if enucleation is done early, and radium applied with a view to prevent its recurrence. Moreover, he has observed the efficacy of radium treatment even in cases where gliomatous tumors had recurred.

We are happy to state that this view, which recognizes the efficacy of radium application for preventing a recurrence, well accords with our views already expressed in the body of this essay.

But the "efficacy" of radium treatment refers apparently to the successful absorption of the recurrent tumors, altho not many months have yet elapsed since the absorptions referred to in Dr. Duncan's reports. The absorption or shrinking of the recurrent tumor in the second case only took place in November, 1917, and that in the third case occurred in June, 1917; so that he cannot yet positively deny metastatic transferences. Besides, we fear that the tumor cells in a recurrent case may not remain in the diseased spot alone.]

SUPPLEMENTARY OBSERVATIONS.

Report on Autopsy Findings: Third case, Makota Ishida. On the inside of the cranium are ten or more flat metastatic nodules, some large and some small, from the size of a pea to that of a hen's egg. These nodules are situated between the cranium and the dura mater, tho the inside of the dura mater is smooth, and there is no alteration in the tissues; only in the nodular portions, the tumor formations appear deep red. The dura mater is generally separable easily from the bone, but in the nodular parts, it adheres to the bone firmly, and when forcibly separated, a tearing sound is produced.

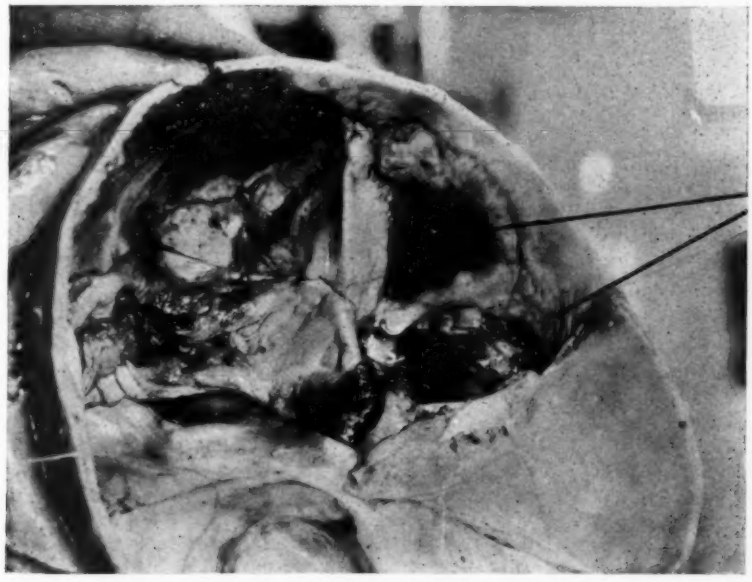


Fig. 6. Anterior cranial fossa with dura detached. Metastatic tumors (m) situated on surface of bone.

The smaller metastatic nodules are attached to the dura mater, and are easily torn away from the cranium, on the inner surface of which they leave mere depressions only (Fig 4, a). On the contrary, the large nodules break and leave tumor tissue attached to the cranium and dura mater. Of these nodules, the biggest one (Fig. 4, b), is situated in the right parietal region, and forms a longitudinally ovate sphere 9 by 5 mm. The tumors break thru the bony walls, and form dark-

blue-reddish eminences on the outer surface.

At the base of the cranium are visible small nodular formations, presenting deep red tumors in the roof of each orbital cavity, and between the cranium and the dura mater; these tumors run along the right temporal region up toward the parietal region. (Fig. 6, m.) Further, when the dura mater of the base of the cranium is torn off, a number of deep red metastatic nodules running out from the orbit are observed. (Fig. 5, m.) The brain and the pia mater are normal and do not show any metastatic nodules.

As for the liver, a portal lymph gland of the liver was swelled to the size of a pea, while the surface of the section showed a deep red tinge. A deep red tumor as big as a hen's egg was prominently visible on the surface of the right lobe of the liver. The surface of the left lobe of the liver looked normal, but the cut surface showed a bisected deep red tumor about 5 mm. in diameter. The tumor, being soft, and a little swollen, was clearly distinguished from the liver tissue around it, which was deep red, sharply contrasted with the yellow section of the liver. Beside this several minor metastatic nodules were found. (Fig. 7, m.)

In the pancreas, too, a little nodule, about the size of a pea, was found at the head.

Fig. 7. Cut surface of liver, bisected deep red tumors (m) are prominent.

The lungs showed bronchitis, and the kidney parenchymatous cloudiness; but no metastatic nodules are found in either.

Microscopic Examination. The capsule of the portal gland of the liver (Figs. 8, t) is thickened, and in one part an infiltration of tumor cells is visible. As to the blood vessels of the capsule, some are filled with tumor tissue, and others with a few blood granules, while the parenchyma is mostly occupied by tumor cells, and severe hemorrhages.

With respect to the liver itself, in its normal portion (Figs. 8 and 9, l.),

the coloring of cell nuclei is insufficient, and a considerable fatty degeneration is apparent; and tho there is no proliferation of the intermediate substance, hepatic lobules reveal a hemorrhagic infarct; and the liver cell trabecula shows an appearance of collapse, tho there is no infiltration of round cells, or new formation of capillary bile tubes.

The tumors in the liver (Fig. 8 and 9, t.), consist almost wholly of glioma cells, and contain little glia fibers, but

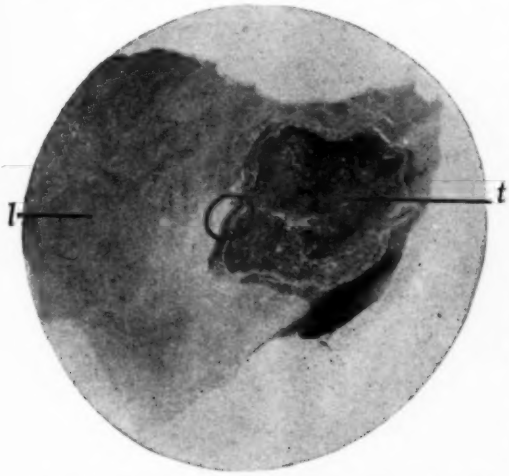


Fig. 8. Microscopic photograph of tumor tissue (t) with normal liver tissue (l). (Leitz oc. 1, obj. 3.)

no ganglionic cells. They are generally of a glandular composition, stained with hemorrhage in several places. In fine, these have the appearance of sarcoma.

In the normal portion of the pancreas (Fig. 10), the intermediate substance has proliferated, but no infiltration of cells is observed. The parenchyma, too, shows no infiltration, and the coloring of the cell-nuclei and the protoplasm is very good. The isles of Langerhans exhibit no special change. In the tumorous part (Fig. 10, t.), the intermediate substance is slight, while the tumors themselves present no glandular tissue, only tissue of a proliferating nature. In this metastatic transference there is severe hemorrhage.

In the liver, as well as the pancreas, the metastatic transferences show little or no infiltration of round cells, or degeneration thereof; on the contrary, they seem disunited.

PREVIOUS OBSERVATIONS.

In general, metastatic transferences of glioma in the head take place mostly in the brain and pia mater. Those that pass thru the bundle of optic nerves, settle in the substance of the brain; and those that go thru the optic disc, in the pia mater.

The former instances are far more numerous than the latter. They swell considerably about the chiasm and sella turcica, thereby overwhelming the adjacent tissues; or rise in the third ventricle, crushing the optic thalamus, or invade the temporal lobes, or the base of the brain, thus filling the greater part of the anterior and middle cranial fossae.

Instances of the latter are generally rare, as has been said above. Such metastatic transferences, when they reach the pia mater, infiltrate there, and usually form circumscribed metastatic seats, soft and flat.

In the present instance, the brain and pia mater were normal, without metastatic involvement.

Metastasis in the cranium is comparatively frequent, the tumors being flat and hemispheric, ranging from the size of cherries to that of the palm of the hand; and the path of transference is usually thru the diploe, some arising from the periosteum, and some from the dura mater. But in the last stage, all the tumors, regardless of their original connection, destroy the whole stratum of osseus formation, the dura mater also being broken thru. In the present case, the metastatic nodules are flat and hemispheric, ranging in size from a pea to a hen's egg. Smaller nodules have settled in the dura mater, medium sized nodules have depressed the inner surface of the skull bone, large nodules firmly attached themselves to the cranium while the biggest have infiltrated the whole osseus stratum, so that the condition is visible externally, showing that they have arisen from the dura mater.

2. *The metastasis in the liver.* Metastatic transferences of the glioma into

the liver are also very rare. The instances I have hitherto been able to study are only eight. All of them, however, are characteristic. Metastatic nodules are numerous, some small, and others large, ranging from the diameter of a pea to 5 or 8 mm. They are full of blood vessels, soft like marrow, mostly white, but in one or two instances, dark brownish red. In the present instance, many metastatic nodules are seen, both small and large, on the surface, and in sections, the largest measuring 5 mm.

According to Wintersteiner, the number of cases of metastatic transferences were: To the

Cranial and facial bones,	40 cases
Brain and pia mater,	43 cases
Lymphatic glands,	36 cases
Parotid glands,	9 cases
Bones of skeleton,	9 cases
The liver,	7 cases
Spinal cord and membrane,	5 cases
The kidney,	2 cases
The ovary,	2 cases
The lungs,	2 cases
The spleen,	1 case

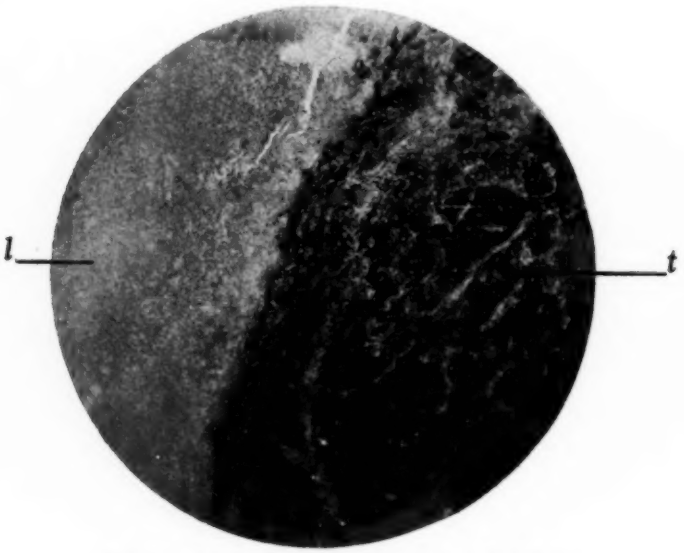


Fig. 9. Enlargement of Fig. 8. (Leitz oc. 1, obj. 7.)

The most extraordinary characteristic of this case, is the deep red color of the tumors, contrasted with the bright yellow tinge of the liver tissues around, enhanced by the fatty degeneration.

3. Finally as to the metastasis in the pancreas, this kind of metastatic transference is quite unprecedented, at least in the available literature. In the present instance, metastatic nodules are found on the upper surface, and microscopic inspection shows the same condition as in the liver.

Metastasis of glioma, in general, is rare, even in its best known form, namely: metastatic transferences into the brain, pia mater, cranium and facial bones.

I find also these further reports of such metastases: Lauber,[12] of the cranium, cervical lymphatic glands, and the lungs; Neese,[13] of the skull bones; Radoliffe[14] and Siegrist,[15] of the liver; Gardiner,[16] of the liver, cranial and facial bones, vertebral column, sternum, or pubis, ischium, cervical lymphatic glands, and testicles; Siegrist,[15] of the brain and pia mater; Kashiwabara,[17], under Prof. Dr. M. Inouye, of the skull bones, spinal cord, and lacrimal gland.

Of the three cases I have investigated, 2 were not dissected; but they showed clinically that one had metastatic nodules in the cranium, parotid glands, glands of the axilla, abdominal glands, the inguinal lymphatic glands.

The other no less clearly indicated transferrence in the pia mater.

Of these, Gardiner's observation on the testicles and Kashiwabara's on the lacrimal glands are new; to which may be added the present investigation on the pancreas.

CAUSE OF METASTATIC TRANSFERENCE.

Finally we must consider the cause of such metastasis. In the three cases we have investigated, all had these fatal transferences; but their cause is doubtful. We may surmise: As our case of retinal glioma was bilateral in its nature, its capability of growth was doubled. The cause might be inherent individuality, but the exposure to X-rays must, we fear, have contributed to the metastatic transference. The X-rays have, no doubt, destroyed the gliomatous tissue on the exterior part of the tumors, but at the same time the rays may have given greater stimulation to their basal portion, so as to quicken their growth. This undesirable stimulation had the effect, it is presumed, of spreading the germ of the tumor thruout the tissues of the body.

According to the statistics of Wintersteiner,[11] double glioma of the retina composes 5 per cent of all such cases, and so it cannot be called very rare. But, as shown above, the occurrence of such metastatic transference is rare, tho it cannot be limited to bilateral cases. If the metastasis of our cases is to be attributed to the bilateral character, it would be contrary to the statistics.

Now, in our cases, if no X-rays had been applied to them, and the retinal glioma had advanced in the debilitated patients to death, such metastatic transference might not have occurred. Therefore, the application of X-rays must be thought to have at least contributed to the fatal consequences.

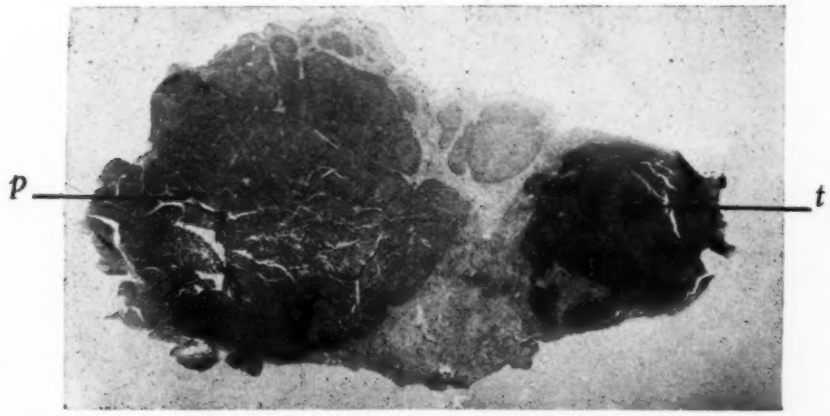


Fig. 10. The pancreas. Tumor tissue (t). Pancreas tissue (p). (Leitz oc. 1, obj. 3.)

REFERENCES

1. Axenfeld, T. Doppelseitiges Glioma Retinae und intraokulare Strahlentherapie. Klin. Monatsbl. f. Augenh., v. 52, p. 426.
2. Axenfeld, T., Kupferle, L. and Weidersheim, O. Glioma Retinae und intraokulare Strahlentherapie. Klin. Monatsbl. f. Augenh., v 54, p. 61.
3. Kusama, K. X-ray Treatment of Retinal Glioma, Nippon Gank. Zasshi, Dec., 1918.
4. Axenfeld, T. Radiotherapie Intraocular. Reun. de la Soc. d'Ophtal., á Heidelberg, 1916. Ann. d'Ocul., March, 1917.
5. Chalupecky. Ueber die Wirkung der Röntgenstrahlen auf die Auge und die Haut. Centralbl. f. Prakt. Augenh., v. 21, 1897.
6. Birch-Hirschfeld. Die Wirkung der Radium und Röntgenstrahlen auf die Auge. Graef. Arch. f. Ophthal., v. 59.
7. Triboudeau and Lafargue. Die Anwendung der Röntgenstrahlen in der Regio Ocularis Arch. d'Electricite Medicale, No. 252. Fortschritte auf dem Gebiete der Röntgenstrahlen, v. 13.

8. Triboudeau and Belley. Arch. d'Electricite Medicale, No. 207. Fortschritte auf dem Gebeite der Röntgenstrahlen, v. 12.
9. von Hippel. Ueber angeborene Schichtstar. Sitzungsbericht 32. Versamml. d. Opht. Gesellsch. in Heidelberg, 1905.
10. Duncan, R. Glioma of Retina with Report of Three Cases Treated with Radium. Amer. Jour. Ophth., v. 1, p. 715.
11. Wintersteiner. Das Neuroepithelioma Retinae, 1897.
12. Lauber, H. Eine Moulage, photographien und anatomischen Präparate eines Gliomas der Retina mit Metastasen. Wiener Ophthal. Gesellsch., 17 April, 1907. Centralbl. f. prakt. Augenh., v. 31, p. 239.
13. Neese. Zwei Fälle von intraokularem Tumore in atrophischen Auge. Westnik Ophthal Nagel's Jahresbericht, 1907.
14. Radoliffe and Goldberg. Ein externer Fall von Glioma Retinae. Arch. f. Augenh., v. 59, p. 55.
15. Gardiner. Bilaterales Glioma der Retina mit zahlreichen entfernt liegenden Metastasen. Arch. f. Augenh., v. 64, p. 93.
16. Siegrist. Setlene Art der Ausbreitung von Gliomen der Retina auf zwei Sehapparat. Bericht über 39ten Vers. d. Ophthal, Gesellsch. p. 390. Nagel's Jahresbericht. 1913.
17. Kashiwabara, K. Retinal Glioma Metastatically Transferred into the Skull-bone, Spinal Column, Ribs and Lacrimal Glands. Ganka Rinsho Iho, v. 10, p. 231.

THE OCULAR COMPLICATIONS OF DENGUE FEVER.

HANS BARKAN, M. D.

SAN FRANCISCO.

This paper calls attention to dengue as probably a cause of such paralyses as are known to be associated with diphtheria, and gives reasons for the belief in such association, and the fact that it has been hitherto overlooked.

A case of abducens paralysis following dengue, and a case of paralysis of accommodation following dengue, seen in my office last August, caused me to investigate the literature. I was under the impression that I had never noted any eye lesions in conjunction with or following dengue reported in medical literature, except the severe pain in and about the eyeball during the height of the fever; my search of the literature found it barren of any mention of dengue and ocular complications. The publication of two cases seems to me, therefore, to be justified.

CASE 1. Mr. A. B., a resident of Honolulu, consulted me August 16, complaining of double vision. This he had first noted on the 9th day after the onset of the acute febrile paroxysm, severe headache, and intense muscular and joint pains with which his attack of dengue had started. The diplopia, while at first very annoying, had become less noticeable, but still embarrassed him, and prevented him from engaging in out-of-door sports, such as golf. He still felt very weak, perspired freely on slight effort, and had lost 15 pounds in weight.

Examination: External inspection negative. Test for ocular movements, balance and range showed slight abducens paralysis, right eye. Fundus negative. Vision 10/10, no glasses worn. Hypermetropia of 0.5 D. Urine negative. Blood Wassermann the same. No history of infection. Transillumination of sinuses, nose, throat and examination of teeth negative. Seen two weeks later, in better general health, had no complaints to make; diplopia could be elicited with difficulty. Discharged.

CASE 2. The day following the examination of the above case, Mr. B. H., also a resident of Honolulu, a friend of my first patient, consulted me. He had had dengue fever at practically the same time. Two weeks after the initial paroxysm on attempting to read, he found it impossible. He now complains of slightly blurred distant vision and inability to read anything but the headlines of a newspaper. His general condition is good.

Examination showed pupils round,

dilated almost maximal, very faint response to light, none to accomodation. Fundus negative. All else negative. Vision was 8/10, brought to 10/10 by +0.5 sph. Reads Snellen 0.5 with +3.5 sph. at 33 cm. In view of the first case, I made the diagnosis of paralysis of accommodation following dengue fever, with a certainly favorable prognosis. Blood examination for Wassermann, and urine examination were both negative. No source of focal infection could be found.

Temporary reading glasses were prescribed. I saw the patient a few times during the next month, during which time the accommodative power gradually returned. When he left for home, 6 weeks after his visit, accommodation was restored completely, altho fatigue in reading would set in rapidly, and the near point recede. Five to ten minutes' rest, however, would enable him to again read Snellen 0.5 at 20 cm. Age 37.

That in both these cases the ocular condition was subsequent and due to dengue fever will not, I think, be questioned. The negative results of all tests and examinations made for the usual and frequent causes of ocular paralysis; the coincidence of both patients having had dengue at the same time and in the same locality; the appearance of the ocular lesion in the first case 9 days after the initial acute febrile paroxysm, in the second case 14 days afterward; and finally, the fact that in both cases the ocular complication involved the neuromuscular apparatus, and was self-limited, with complete recovery, establishes with as much certainty as is possible, the connection between the attack of dengue fever and the subsequent ocular complications.

It might be asked whether or not they had dengue fever in the first place. The description of the disease as given by both cases presented the typical symptomatology,—they were suddenly seized with an acute febrile paroxysm, chills, accompanied by very severe pains in all muscles and joints, intense headache and complete prostration. On the first day both had extreme anorexia and vomiting. The maximum temperature was said to have been between 104° and 105° on the 4th day. While no rash was noted at first, it appeared on the 5th or 6th day, being most prominent on the face, tho there was some also on the arms, trunk, thigh and legs. A bran-like desquamation lasting a week, occurred on the 13th or 14th day. On the 9th and 14th days respectively, the patients noted the ocular symptoms. A note written to their medical attendant in Honolulu has met with no response; but from the above, there is no other disease that can have afflicted them, especially in a locality where dengue is endemic.

Considering the connection between the ocular lesions and dengue as being established, it may not be out of place to review in brief the established facts regarding dengue fever, sometimes known as dandy fever (because of the stiff and mincing walk), break-bone fever, stiff-necked fever, giraffe fever, polka fever, bouquet fever, (corrupted into bucket fever), knockel-koorts fever, and by other descriptive popular names. The description of the disease as given above is the typical form.

It may occur so suddenly and with such complete prostration as to strike down the sufferer at his business, pleasure or devotions. The intense and excruciating myalgia and joint pains are the most typical symptoms. Here may be mentioned the only ocular complaints occurring as a rule, namely the intense retroorbital and supraorbital pain, and often great pain on attemped ocular movement. The disease lasts from 10 to 14 days, during which time the temperature is usually highest on the 4th or 5th day, varying between 103-106° F. There is then often a remission in symptoms followed by return of symptoms and by a rash, described previously. Death following dengue is practically unknown. The complications and sequelae are few, occasionally hemorrhage from mucous surfaces, inflammation of serous membranes, and rarely pleurisy, orchitis, pericarditis and endocarditis.

The disease is one usual in tropical and subtropical countries, although it has occurred in outside zones, as, for instance, in Philadelphia, New York and Boston, appearing in the summer and disappearing in winter. In tropical countries it

stays fairly well confined to the coast and adjacent country, especially along the routes of travel. It occurs in both dry and moist atmospheres, altitude, however, acting as an inhibiting force.

The cause is still uncertain; from analogy some insect as a carrier would seem most probable. While some investigators have found a hematozoön in the red blood corpuscles, leucocytes and occurring free in the blood plasma, and have found this same organism in the stomach of Culex fatigans up to the 5th day after being fed upon blood of patients ill of dengue fever, other competent investigators deny its existence. The main points of agreement are that the pathology consists of a well-marked leukopenia, the polymorphonuclear leucocytes being decreased, with a marked increase in small lymphocytes; that it can be transmitted through Culex fatigans, and that is probably the common method; and that the organism is probably ultramicroscopic.

Returning for a moment to the two cases cited,—in countries where dengue is endemic, ocular muscle paralysis from other causes certainly exists, and when large numbers of the population are afflicted with dengue, certain ones might very well develop an abducens paralysis or accommodative paralysis during the fever, not in relation to it, but rather as the result of some of the common causes. This is not likely in the two cases cited, as both proved absolutely negative in the search for an inciting cause other than dengue.

It is also conceivable that due to the prostration occurring with dengue, an ocular paralysis from another cause might be favored and accelerated in its appearance, just as, for instance, in a heavy smoker and alcoholic, a tabetic nerve atrophy is apt to take a rapid course. Again, in view of the negative examination, this is not likely to have been the case in these two instances. It might be said that because 75 per cent of the population in some influenza epidemics is infected, therefore ocular lesions occurring in these are not related to the influenza, but would have occurred in the same number and time if free of influenza. But we know, for instance, that certain ocular diseases, such as herpes corneae, are much more frequent during an epidemic of influenza, and much rarer before and after an epidemic.

In dengue we are acquainted with one constant ocular symptom, the intense aching of the eyes, whether a true myalgia or a slight degree of serous tenonitis, or periostitis, is uncertain. It is rather surprising that ocular complications, such as the two cases of muscular paralysis I report, are not more common; there are many similar points in dengue and influenza. With the existing similarities it is curious that dengue has not been known to be complicated by ocular diseases common in association with influenza, —one need think only of acute hordeolum, keratitis neuroparalytica, herpes corneae, keratitis punctata superficialis, neuritis optica, muscular paralysis, iritis, etc.

As dengue occurs so largely among the ignorant tropical population, and as ocular sequelae may be late effects, it is quite conceivable that they may occur frequently, but be overlooked, especially if they be ocular paralyses causing no pain or inflammatory signs and recovering spontaneously.

AN OPERATION RELEGATING ENUCLEATION OF THE EYE TO ITS PROPER POSITION.

T. J. DIMITRY, M. D.

NEW ORLEANS.

This paper presents an argument for a better operation to replace the enucleation of the eye in most cases. It describes such an operation, which the author has performed in twenty cases, and discusses its technic and results.

The reason for this contribution is to again insist that my confréres take cognizance of a superior surgical technic which should, in the majority of instances, replace enucleation, a quite unsatisfactory operation when considered as to its cosmetic, and, hence, as to its economic, results.

The enucleation of the eye is a rapidly and rudely performed procedure, and generally gives the impression that the sole aim of the operator is to get the offending member out. The muscles attached to the eye are cut, the optic nerve is severed, the eye delivered and hemorrhage controlled by pressure —this nonesthetic and purely mechanical procedure is the accepted performance, and it constitutes the operation of enucleation. Any nicety of technic aimed at obviating disfigurement is very generally ignored.

When the prothesis is inserted, following this crude surgical procedure, three highly unsatisfactory conditions, to say the very least, are almost surely present. We have an artificial eye sunken deeply in the socket, with a consequent lack of symmetry with the natural eye; we have sagging lids, and we have an eye staring rigidly and vacantly into space. Injury to the sympathetic incident to the operation of enucleation has been considered in a previous paper[2] as a probable factor to account for these unsatisfactory conditions; but, in addition, there are primarily some purely mechanical factors worthy of note: (a) the deeply sunken artificial eye can be attributed to the practically empty socket resulting from enucleation; (b) the sagging lids to the disturbance in relation between tension of, and pressure against, the palpebral muscles caused by the sunken prothesis, and (c) the rigidly staring eye results from the severed recti muscles.

These deformities are inexcusable, and can be avoided. Hence it is that I have been insistent that we improve upon what is undoubtedly a faulty surgical procedure, however skilfully it is performed.

I grant that enucleation may be compulsory in malignant conditions of the eye, or justifiable, as in advanced age, where appearances count for little as against the necessity for a rapidly performed operation; but it is not even justifiable in any one other single condition.

The laudable efforts of our government to rehabilitate the injured and disfigured soldier, and to restore him to a condition where he can most readily earn his own livelihood, should teach the lesson that the removal of the eye in civil practice should not be considered on a parallel with the emergency operation of the battle field that so often makes necessary later plastic treatment.

The civilian surgeon also is today removing postoperative disfigurements solely with the view of a cosmetic improvement; and much of this plastic surgery would be unnecessary had the patient been rationally handled in the first place. Yet, with respect to eye surgery, or to that part of it under consideration, very little is being done to preserve a normal appearance; and we must admit that a good appearance has no inconsiderable economic value.

Postoperative appearances are to be shown every consideration, and we must use the utmost care in preventing any avoidable disfigurement consistent with the welfare of the patient. That the observance of this surgical principle has been, and still is, so flagrantly ignored by the ophthalmologist, above all others, seems to me inconceivable.

I am familiar with the fact that some few surgeons are using tardy methods to correct, or to a lesser degree, seeking to prevent, these unsatisfactory results of an imperfect technic. But they are very few, and it is exceedingly difficult to gain serious attention to anything having a semblance of contrariness to text book teachings. Under the circumstances we would be justified in demanding that our teachers and authors more insistently impress upon the tyro the exact limitations of the operation of enucleation; for this operation is so easily performed, and so comparatively free from danger, that this inexperienced man is enucleating the eye at the slightest pretext. Some even have the conceit, once they have performed this operation, to regard themselves as finished surgeons.

The authentic case of the man who attempted to qualify as a brain surgeon in the Medical Reserve Corps for the sole reason that he had successfully treated scalp wounds during a considerable industrial practice, has its analogies in the records of the office of the Surgeon General in some instances where men wished to qualify as finished ophthalmologists for the reason that they had successfully enucleated the eye.

If we consider the muscles of the eye, situated in pairs each conveniently opposite its mate; and when we consider that so few make any serious attempt to utilize this great opportunity to conserve a practically normal muscular action, even by end to end suturing, and, further, that this undoubted neglect of opportunity acts to the detriment of the patient, both cosmetically and economically, I am impelled to ask if the operation of enucleation, as commonly performed, can be considered as a rational surgical procedure in the great majority of cases. My answer is that it cannot be so considered.

My operation is advocated for the reason that it practically obviates injury to the sympathetic nerve, conserves the normal movements of the eye, provides a foundation for the prothesis, and hence, a filled in socket, all tending to prevent disfigurement, and in that it exposes the patient to no greater risk from sympathetic ophthalmia than does enucleation.

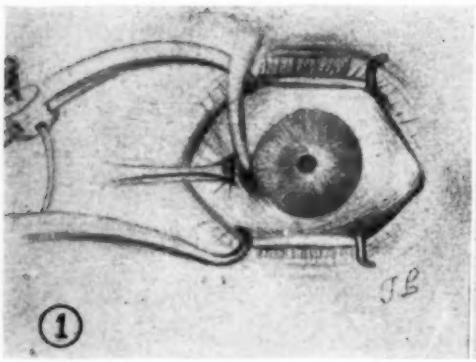
Any consideration of other substitute operations must take into account especially the important question of sympathetic iridocyclitis; and the writer, before first advocating his operation, had given serious thought to the other substitute operations for enucleation. His early opinion that the advocated operation provides for all eventualities to a greater extent than do other substitutes is now more firmly fixed than ever.

The advocated operation is an *evisceration of the sclera, with the removal of a section of it* POSTERIORLY *including a severance of the optic nerve.* A gold ball is inserted within the sclera, and the anterior opening is closed. The posterior opening is not closed. This latter feature is very essential, and a little thought should convince one of its merits.

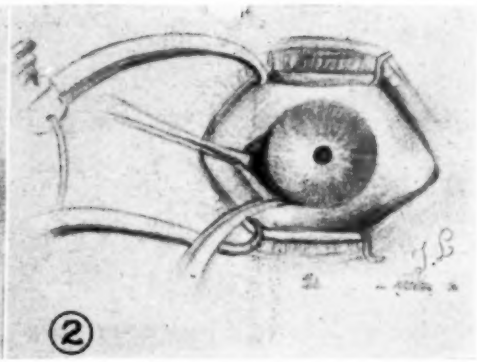
The procedure begins as in an evisceration; that is, the conjunctiva is first undermined, and the anterior aspect of the globe is resected. The point of resection is about 2 mm. posterior to the corneoscleral junction. The contents of the globe are removed, and any possible slight hemorrhage is easily controlled. A section is made in the posterior aspect of the sclera from within, and, at the same time, the optic nerve is severed.

This latter procedure is quite readily carried out by puncturing the sclera with a Graefe knife, and with a pair of curved scissors cutting in a circle around the insertion of the optic nerve, thus severing it from the sclera. The detached portion of the sclera with its attached portion of nerve are then removed after section of the latter. The long ciliary nerves may also be cut, if desired; but it is not the custom of the writer to do so.

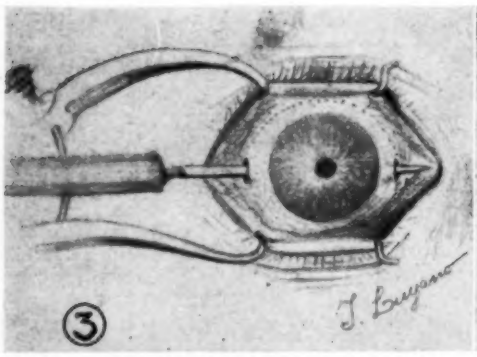
The sclera is now turned from within outward, evaginated, and every vestige of choroidal tissue is removed. It is then returned to its normal position, invaginated, and two small triangular sections of it removed at both sides of



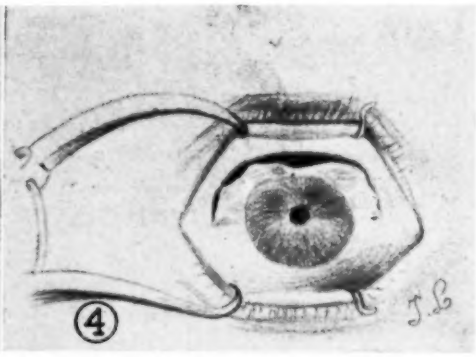
TO OPEN CONJUNCTIVA



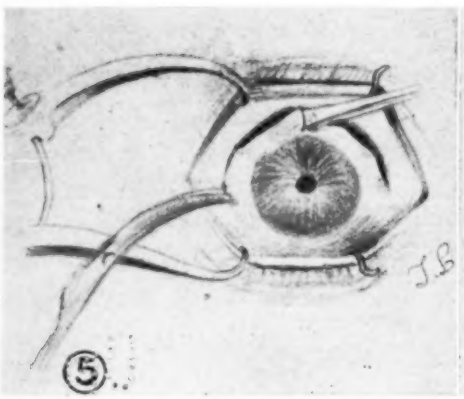
TO FREE CONJUNCTIVA



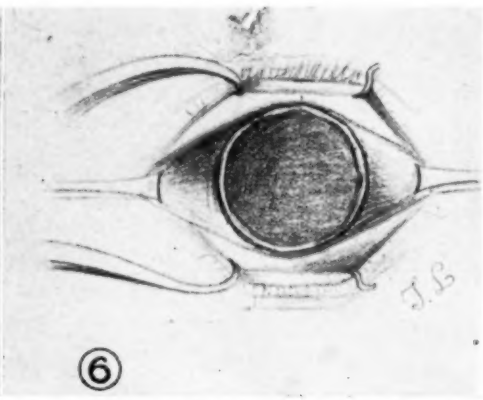
TRANSFIXED WITH GRAEFE KNIFE



UPPER FLAP CUT WITH GRAEFE KNIFE

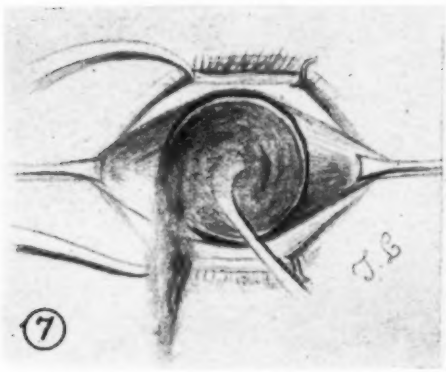


READY TO EXCISE ANTERIOR SEGMENT

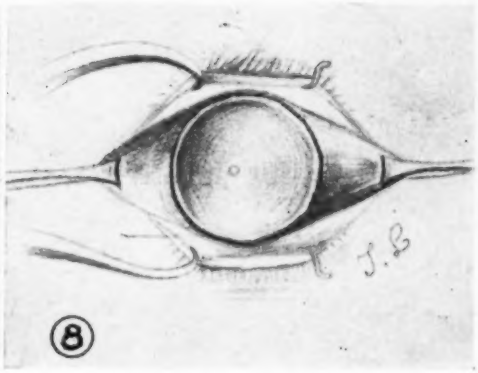


ANTERIOR SEGMENT EXCISED

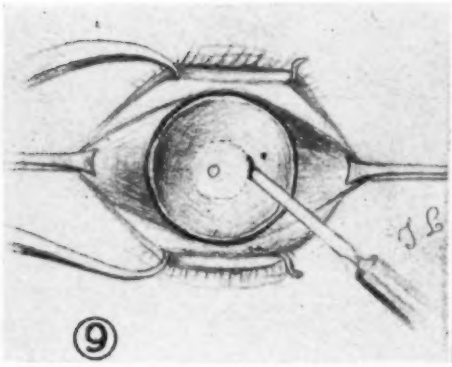
DIMITRY'S SUBSTITUTE FOR ENUCLEATION



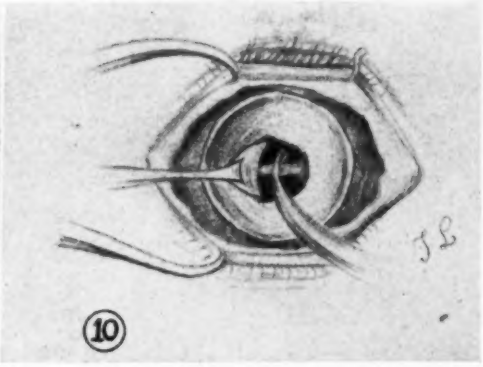
REMOVING CONTENTS OF SCLERA



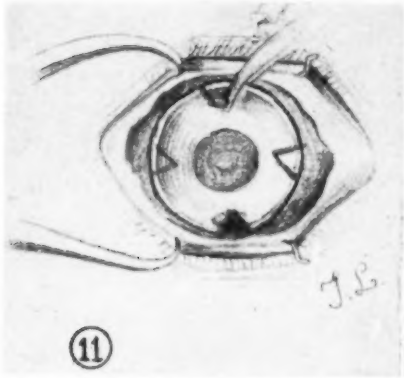
SCLERAL CAVITY EMPTIED



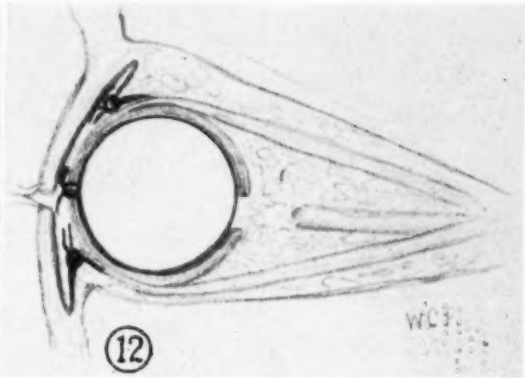
CUTTING WINDOW IN BACK OF SCLERA



DIVIDING OPTIC NERVE



CUTTING TRIANGLES OUT OF SCLERA



SCHEMATIC SECTION SHOWS GOLD BALL INSERTED—WINDOW POSTERIORLY THROUGH SCLERA—OPTIC NERVE CUT—CONJUNCTIVA SEWED TO TENON'S CAPSULE, NOT OVER SCLERA

DIMITRY'S SUBSTITUTE FOR ENUCLEATION

the anterior window, and in such positions that a horizontal line bisecting the latter will also bisect the triangular openings. The gold ball is then inserted, and the sclera is sutured over its anterior surface. The conjunctiva is sutured to the capsule of Tenon at the position of its attachment to the sclera, and, hence, is not brought over the sutured anterior wound in the sclera. The operation is now complete.

The triangular openings are for the purpose of securing a more snug fit of the sclera over the ball; and the above manner of attaching the conjunctiva secures a firmer, and a larger area of curvature for the artificial eye. The recti muscles, having been left attached to the sclera, retain their ability to function; so that, what remains of the eye, with its implanted gold ball, is capable of practically the same scope of movement as was the eye before operation.

When the prothesis is inserted, it sits on a filled-in socket, is protected by lids which do not sag, and, on account of the larger cul-de-sac resulting from the retroattached conjunctiva, is capable of practically the same scope of movement as the normal eye. This combination constitutes a veritable camouflage.

The two original features of this operation, in which it differs from all similar operations, are the posterior window in the sclera, and the method of attaching the conjunctiva. The questions of sympathetic ophthalmia and extrusion of the gold ball will now be considered.

The two most widely accepted hypotheses to account for sympathetic iridocyclitis are perhaps that of Leber and Deutschmann, and that of Rimpler.

If the former theory is correct, and sympathetic ophthalmia is due to the infectious virus reaching the sound eye by way of the lymphatics of the optic nerve, unless the retained sclera is the focus of the infection, which is extremely improbable, the advocated operation protects from this untoward eventuality to the same extent as does enucleation, for the optic nerve is severed.

Those who are partial to the cilioneural theory of Rimpler, that an irritation of the ciliary nerves of the eye first affected induces a susceptibility to the disease in the sound eye, will find it not difficult to sever these nerves at the same time the optic nerve is severed.

I have had no case of sympathetic ophthalmia following my operation, and, as stated, it is not my custom to sever the ciliary nerves.

Probably due to the posterior window in the sclera taking care of the exudates and small hemorrhages, or equalizing pressure, or both, I can report twenty (20) cases operated by my method without a single extrusion of the golden ball.

Eighteen (18) of these cases were operated under a general, and two (2) under a local anesthetic.

Two cases date back five years, 4 four years, 4 three years, 5 two years, and 5 one year. I have seen the great majority of these cases since the operation, and have still later communicated with most of them. My expectations of the operation have been fulfilled in every respect with each case; and, furthermore, while about half of these operations have been performed upon children, in not one instance have I yet noted anything even approaching an asymmetric development of the face.

Following the implantation of other substances in place of the gold ball, such as fat, cartilage, the eye of the rabbit, paraffin and dental wax, my results have been, on the whole, not satisfactory. Were it not for these investigations with the substances named above, I would be able to report many more cases of this operation at the present time.

Fat is quickly absorbed, as is the eye of the rabbit, altho not so rapidly. Paraffin and dental wax have given the poorest results, for they, and particularly the latter, cause a great deal of irritation. Cartilage, barring the great difficulty in procuring pieces suitably shaped for the purpose, seemed to give rather satisfactory results, but unfor-

tunately I was unable to keep the two cases where it was employed under observation for a sufficient time to note final results. However, I can see in its use no advantage over the gold ball; in fact, rather the contrary.

In further defense of my stand, I shall quote from Allport, in The American Encyclopedia of Ophthalmology,[1] under the caption of Choice of Method in Eyeball Excision: "In the majority of cases this mutilating and deforming operation of enucleation is entirely unnecessary and should be relegated to obscurity, that it may make way for better, more modern and more humane surgical procedures."

In conclusion, the advantages of the operation may be summed up as follows:

(1) It may be performed with a comparative absence of trauma; and, hence, is followed by less reaction, less secretion and less ecchymosis, with less likelihood of injury to the sympathetic, than is the case after enucleation.[2]

(2) It furnishes a filled-in socket with its several advantages; a firm seat for the prothesis; an absence of sagging lids, and, hence, a normal lacrimal secretion and drainage.

(3) It evidently does not interfere with a natural face development in the young.

(4) It leaves the recti muscles undisturbed and with an unimpaired power to function.

(5) The posterior window permits of the easy severance of the optic nerve; it permits of ready absorption of hemorrhages and exudates, and obviates extrusion of the gold ball.

(6) The retroattachment of the conjunctiva furnishes a deeper retrotarsal fold permitting unrestricted excursions of the prothesis.

REFERENCES.

1. Allport, F. American Encyclopedia of Ophthalmology. v. 6, p. 4396.
2. Dimitry, T. J. Injury of the Sympathetic in Enucleation. Ophthalmic Record, v. 26, p. 183.

A TEST FOR THE JUDGMENT OF DISTANCE

CAPTAIN HARVEY J. HOWARD, M. D., OPH. D.

PEKING, CHINA.

This paper reports the results of investigations carried on at the Medical Research Laboratory, Hazelhurst Field, Minneola, N. Y. It was read at the American Ophthalmological Society, June 16th, 1919. Authority to publish granted by Board of Publication, S. G. O.

The much discussed question of the judgment of distance has suddenly come to have, thru the advent of military and naval aviation, a very important and practical application. The literature on the subject is voluminous. One finds, however, that it is rich in the amount of theory from the physiologic, psychologic and philosophic viewpoints, but exceedingly meager in experimental data, most of which were published several decades ago. It is the practical phase and consequently the experienced data which most concern those of us interested in the examination and classification of applicants for the aviation service. We are eager to know how and why we are able to judge distance, but our chief object is to learn what the individual ability of men along this line actually is.

STATUS OF THE PRESENT TEST.

The test for the judgment of distance is referred to in our aviation manual as the test for "stereoscopic vision." For this purpose a hand stereoscope, with specially made sets of stereoscopic charts is used. In the

majority of cases this test is satisfactory as far as it goes. But it does not permit of any except rough distinctions. No accurate classification, based on a subject's relative ability, is possible. Either he projects all of the pictures fairly accurately or he gets no projection at all. On this basis he is rated as "normal" or "not normal." Also, the ability to fuse stereoscopic pictures is impossible for some individuals who have very good judgment of distance. Artificially produced stereoscopy with them is an act wholly new in their experience; the harder they try the more confused they become. Some finally learn the trick, others never do, so it is safe to assume that among the applicants who were excluded on account of this technical inability there must have been some who had good judgment of distance and consequently were unjustly debarred from the service. Nor does the stereoscopic test preclude the possibility of an over zealous applicant having learned the respective positions of the objects in the picture prior to his examination. Indeed, such an explanation is the least critical and perhaps the most ethical way of accounting for a number of cases of faulty binocular vision recently found among the flyers, especially since all the evidence pointed to the fact that this was not a recent condition.

On the grounds that there are flyers now in the service with faulty binocular vision and a few with only monocular vision, some examiners have questioned the absolute necessity of binocular single vision as a preliminary requirement. Upon sober reflection, however, one must conclude that the knowledge that a number of men with faulty binocular vision have been admitted to flying service and are still living, does not constitute a proof that even a larger number have not met an unnecessary death on account of having been wrongly permitted to fly. It is error in judgment of distance in landing a plane that has caused the great majority of deaths among cadet aviators. The Manual of the Medical Research Laboratory, 1919, in discussing this subject says, "Speaking of error of judgment in flying as a cause of aeroplane accidents, Anderson states that this accident may occur in getting off the ground, in the air, or when landing. To 58 crashes in the 'V' series, this accounted for 42, 4 in getting off the ground and 38 in landing." It is impossible to make post-mortem confirmation of the binocular vision of those unfortunate flyers, but it seems logical to insist on a safe-guard that seems so obviously necessary.

In view of the criticism of the hand stereoscope as a satisfactory test for the judgment of distance, it fell to my lot to find or devise a test which would be free from that criticism. In order to undertake the subject with the proper background it has been necessary to go into the subject of the judgment of distance rather fully. I shall endeavor, then, to give a brief summary of that subject with reasons for deciding upon a certain form of apparatus which seemed to fulfill the requirements which I sought and had the added advantage of being extremely simple in construction.

FACTORS INVOLVED IN JUDGMENT OF DISTANCE.

Judgment of distance is dependent upon several factors. Some of these factors operate for both monocular and binocular vision alike. The others act only when binocular single vision is present. In brief, the latter possesses all the factors that monocular vision has, and in addition has at least two others. The distinctions may be represented as follows:

A. Factors common to both binocular and monocular vision:

1. Size of the retinal image.
2. Accommodation.
3. Motion parallax.
4. Terrestrial association.
   (a) Linear perspective.
   (b) Overlapping of contours.
   (c) Light reflections and shadows.

5. Aerial perspective, i. e., the changes with respect to color, brightness and contrast which distant objects undergo on account of variations

in the clarity of the intervening atmosphere.

B. Factors operating only with binocular single vision:

1. Binocular parallax.
2. Convergence.

In employing a test for the purpose of classification it is necessary to utilize only that factor or those factors which operate to make for an individual difference in ability. All other factors should be eliminated in such a test. Is it possible to isolate and thereby examine the factor showing the most individual characteristic? The following argument should answer this question:

Motion parallax is produced either by movement of the observer or by objects within his field of vision. For that reason it may be considered an artificial factor employed only to enhance the already existing facility. It should, therefore, be eliminated as a factor not related either to innate or to acquired individual ability.

Factors external to ourselves which assist all of us equally, such as terrestrial association and aerial perspective should also be eliminated for the same reason.

Factors which operate only for short distances and either not at all, or only very slightly for distances of six meters and over, do not need to be considered when examining prospective aviators. Therefore, accommodation and convergence should be eliminated.

The two remaining factors are the binocular parallax and the size of the retinal image. It is possible to obtain the relative values of these two factors by using the same test apparatus, first with two eyes and then with only one eye. In the first instance both factors may operate together; in the second instance the binocular parallax is eliminated and only the size of the retinal image can operate. This latter is practically as important a factor with one eye as it is with two. If by comparison it be found on the one hand that the results are the same or approximately the same, it is obvious that the size of the retinal image which operated in both tests, is the important factor. If, on the other hand, it be found that the binocular test produces a far more delicate discrimination than the monocular, we are forced to the conclusion that the binocular parallax is the more important factor and the size of the retinal image is negligible or practically so. The results of just such tests were obtained and have been tabulated in this report and conclusions deduced therefrom.

It may be wise at this point to correct what may result in an erroneous impression from the foregoing statements. There has been no intent to belittle the other factors to the advantage of the binocular parallax and the retina image. These other factors must play a very important part in judging distance properly. It may be that taken as a whole, they assist us as much as the factors specially referred to. It may also be true that our experience teaches us to use these factors more and more, especially when suddenly deprived of the binocular parallax thru the loss of an eye, but it must be maintained that except for convergence and accommodation they are factors extraneous to the individual and do not represent that difference in ability characteristic of him. In addition they are not constant but vary greatly with atmospheric changes and environment, whereas binocular parallax is subject to no variation per se.

THE PROBLEM OF A SUITABLE APPARATUS.

The problem, therefore, was to devise an apparatus which would eliminate all factors except the binocular parallax and the retinal image. The test should also permit of our common every day method of depth perception without interposing the feat of fusing stereoscopic pictures. The apparatus then should be employed at a distance of at least six meters. The test should be as conventional as possible and simple, and should permit of fine discrimination. Finally to avoid the possibility of motion parallax a head rest should be used.

In searching the literature I was fortunate in finding the description of an

apparatus devised by Brooksbank James,* of England, in 1908. With a few modifications and the addition of a head rest this seemed to meet all the requirements.

*"Measurement of Stereoscopic Visual Acuity," Lancet, June 20, 1908, p. 1763.

DESCRIPTION OF THE APPARATUS.

The framework consists of three sides of a box, the back, the bottom and the front. The inside measurements of the front and back are 58 cm. high and 75 cm. wide; the floor is 55 cm. from front to back and 75 cm. wide.

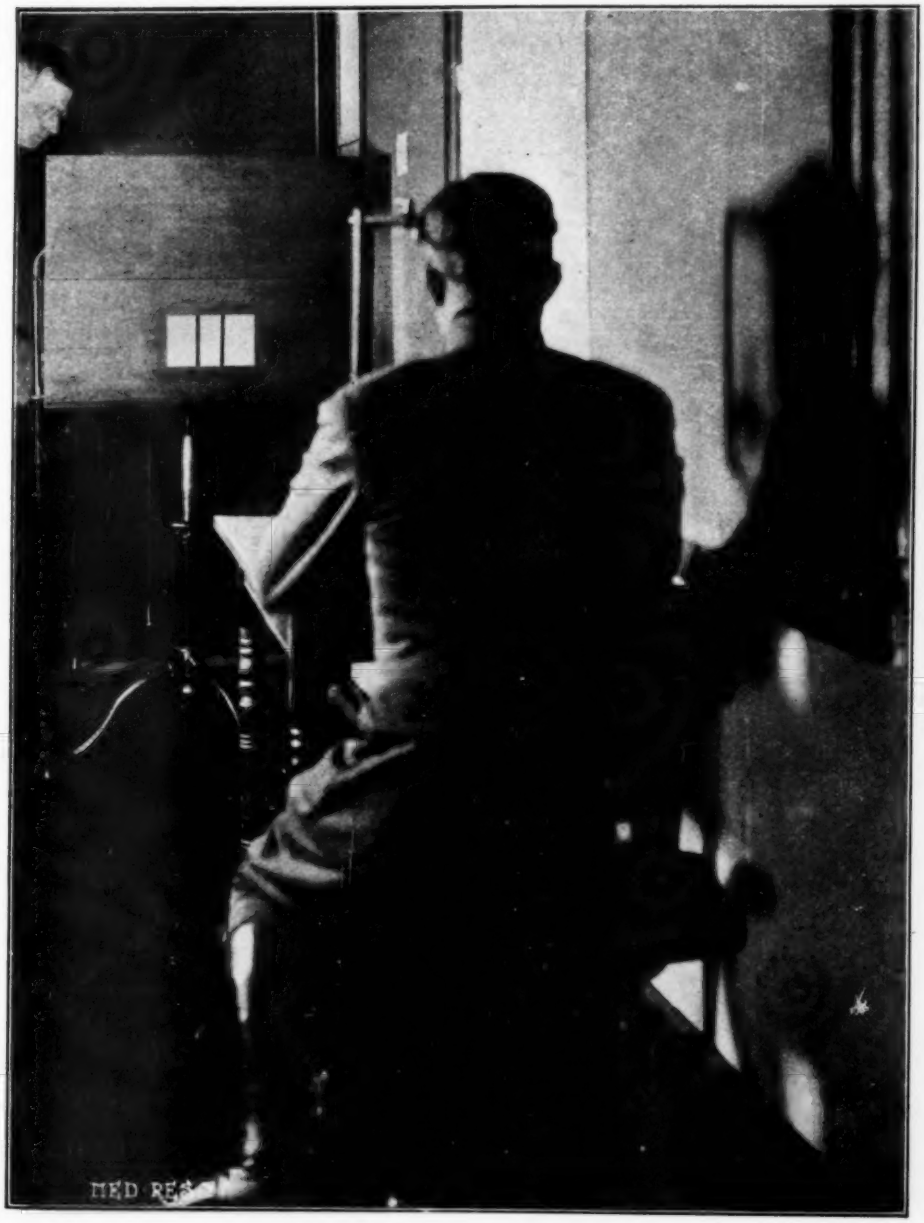


Fig. 1. A subject making an observation.

The anterior and posterior surfaces of the front partition and the floor are painted a dead black. The anterior surface of the back partition is covered with a sheet of dead white cardboard. In the middle of the front partition a window is cut 20 cm. wide and 12 cm. high. The upper margin is 38 cm. from the top of partition.

Extending from front to back a board 12 cm. wide and 2 cm. thick is permanently fixed over the center of the floor. Before being fixed, this board is marked off with a scale 0.5 cm. apart. Two parallel lines 6.0 cm. apart are also drawn the length of the board. Where the scale and parallel lines cross small holes are bored with an electric drill. The holes are made for the purpose of carrying upright wooden rods or dowels. There rods, which are 1.0 cm. in diameter and 26 cm. long are smoothed with sand paper, painted black, and carefully modeled at one end to fit into the holes.

The rods are illuminated by indirect light from the white surface of the background. The source of light is a 75 watt nitrogen lamp carried by a flexible goose neck attached to a floor stand. The lamp is set about 20 cm. in front of the back partition near to the top of the apparatus but low enough to be hidden from the view of the subject to be examined. A Hubbell aluminum reflector casts the light rays onto the white background at an angle of 45 degrees.

A cardboard screen is placed behind the window to prevent the observer from watching the operator adjust the rods. The latter stands at the left side of the apparatus which is placed upon a table adjustable to any required height.

The only remaining apparatus is a Trolland headrest attached by a clamp to the edge of a table six meters in front of the box.

METHOD OF EXAMINATION.

The test is carried out in the dark room with the source of light as indicated above. The subject or observer is seated in a chair with his head securely but comfortably fixed in the headrest. (See Fig. 1.) The apparatus is adjusted so that the eyes of the observer are exactly six meters from the zero mark or middle of the cross scale on the rod carrying board. Adjustment is also made so that the observer's eyes are at the same height as the middle of the window. This latter precaution is necessary to avoid any chance of linear perspective entering in. Therefore, when the rods are placed in position and the screen lifted neither the bottoms nor the tops of the rods are visible, but only the middle one-half or thereabouts.

When everything is ready the observer is told to fix a point near the center of the screen. The screen is suddenly giving practically an instantaneous view of the rods. The observer is required to state which of the two black rods is nearer to him, the right or the left. He is informed at the beginning of the test that at no time will the rods be set in the same reference plane, i. e., they will not be equidistant from his eyes. His judgment is therefore, reduced to the simplest terms, viz., which rod is the nearer. At the same time all effort is made to deceive him as to the relative positions of the rods. A pack of 20 blank playing cards are lettered, ten of them "right" and ten of them "left." These cards are shuffled before the judgments are taken at each station, and the positions of the rods determined in the order indicated by the cards.

Twenty judgments are taken at each of five stations. As a rule the first station observed represents the 30 mm. depth difference, i. e., when one rod is in a reference plane 6,000 mm. away from his eyes and the other 6,030. If the twenty judgments are all correct, the observer is tried successively at the 20 mm., the 15 mm., the 10 mm., and the 5 mm. stations or until it is apparent by the number of wrong judgments that he is merely guessing or actually projects the farther rod nearer than the other. If the judgments at the 30 mm. station are not all correct the observer is tried at the 40 mm., the 50 mm., the 60 mm., and the 90 mm., sta-

tions, etc., i. e., until his judgments are all correct.

EXPLANATIONS OF TERMS AND DIAGRAMS.

When we look at two objects to compare their relative distance we make our judgment by the difference in their distances from us. In Figure 2, A and B represent the two eyes and O and O¹ the two objects respectively. The two distances may be represented by imaginary lines, one from O and the other from O¹ to a point midway between the two eyes, that is, to an imaginary cyclopean eye. These distances may be compared with less difficulty by using a more diagrammatic drawing. Let us therefore, consider one eye B and the two objects O and O¹ in a straight line as in Figure 3. In this Figure let

p=AB, the interpupillary distance
d=BO, the shorter distance
D=BO¹, the longer distance
D—d=Δ, the difference in distance or as it is termed in this paper, the *depth difference.*

Also let ∠ 1=∠ AOB, the angle of convergence upon the near object; and ∠2=∠AO¹B, the angle of convergence upon the far object; and ∠3=∠OAO¹

Then ∠ 1—∠ 2=∠ 3, which is the binocular parallactic angle represented by the depth difference D—d or Δ.

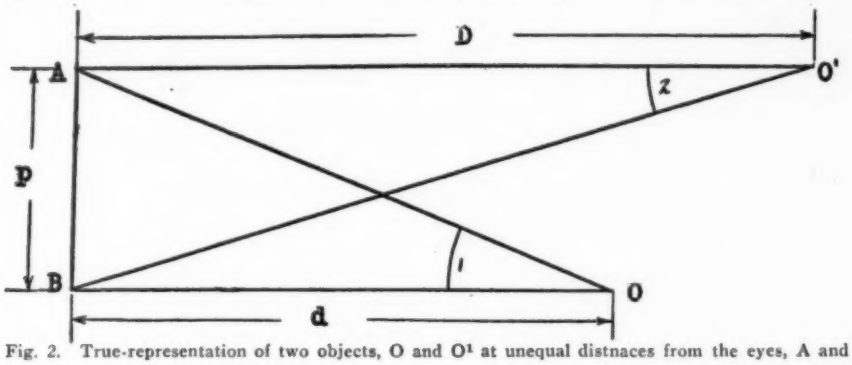


Fig. 2. True-representation of two objects, O and O¹ at unequal distnaces from the eyes, A and B.

For small angles like angles 1, 2 and 3, the sine, the tangent and the angle in radians may be considered equal with negligible error.

Let r=angle 3 in radians.

then tan. of angle 1 $= \frac{p}{d}$ and tan. of angle 2 $= \frac{p}{D}$ and r $= \frac{p}{d} - \frac{p}{D} = \frac{p\,D-d}{Dd}$

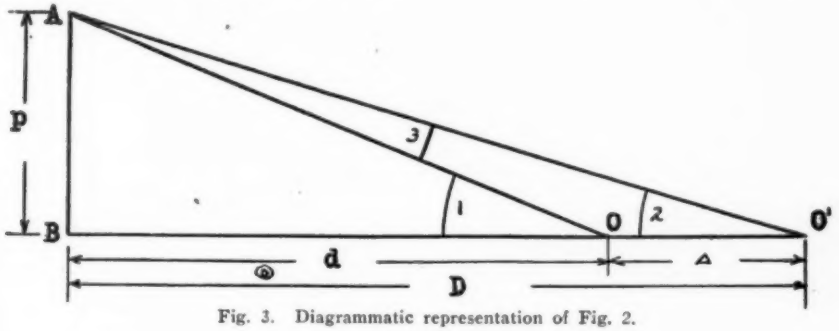


Fig. 3. Diagrammatic representation of Fig. 2.

But when p=0.063 meters, and d and D are 6.000 and 6.005 meters respectively, then by substitution

$$r = .063 \frac{.005}{6.000 \times 6.005} = 0.00000874,$$

which represents the binocular parallactic angle in radians.

In order to convert radians to de-

grees of arc we must multiply radians by $\frac{180}{\pi}$ and then this result in degrees by 3600 to obtain the final result in seconds of arc.

Therefore 0.00000874 radians= 1.803″.

This angle 1.803″ is the binocular parallactic angle when the interpupillary distance is 63 mm., the depth difference 5 mm., and the distance of the nearer object 6 meters.

On the basis of this formula, the binocular parallactic angles were worked out for interpupillary distances ranging from 57 to 72.5 mm. and for depth differences ranging at regular intervals from 5 to 360 mm. (See Table I.)

RESULTS OF THE TEST.

One hundred and six subjects or observers, seventy-five of whom were aviators, were examined with the apparatus. Prior to the test other visual data were recorded, such as: age, army service, hours of flying if any, vision, muscle balance, near points of convergence and accommodation, and interpupillary distance.

The classification of a subject is not made on the basis of the shortest depth difference at which he gives twenty consecutive correct judgments, but rather upon the shortest depth difference at which he is still at or within his threshold, i. e., when at a certain station the subject makes 15 correct and 5 wrong judgments, the calculation may be made as follows: The 5 wrong judgments may be classified as guesses. To offset these 5 correct judgments should be eliminated also as guesses. That leaves 10 correct judgments which represents the number which the subject actually distinguishes, i. e., just 50% of the total number of 20. I have accepted therefore, as the threshold of any individual, that least depth difference at which his judgments are correct not less than 75% of the time.

The ability of the 106 observers varied greatly. It was found convenient to classify them into twelve groups based upon their depth-difference thresholds. This classification with all correlating data has been recorded in Tables II to VII.

It was found that fourteen men had judgment of distance to a remarkable degree. According to a formula expressed above, their respective binocular parallactic angles depend not only upon their depth difference threshold, but also upon their interpupillary distance. Their depth-difference thresholds were as small as 5 mm. Their interpupillary distances varied from 63 to 72.5 mm. It is obvious that the man having the smallest interpupillary distance would have the smallest binocular parallactic angle. By referring to Table II we find that the smallest interpupillary distance 63 mm. represents a binocular parallactic angle of 1.80″. The longest interpupillary distance 72.5 mm., represents an angle of 2.07″. This difference in angle of 0.27″ denotes an advantage of about 15% that the man with the longest has over the man with the smallest interpupillary distance, i. e., their actual ability is the same but the latter observer with the 63 mm. interpupillary distance must have a threshold angle of not more than 1.80″ in order to equal the discriminating ability possessed by the 2.07″ angle of the man with the interpupillary distance of 72.5 mm.

The parallactic angle of the remaining twelve observers in Class A ranged between 2.07″ and 1.80″. The average threshold for the entire fourteen men was 1.89″.

Class B, Table III, represents a group of thirty men with a threshold of 10 mm. and a binocular parallactic angle averaging 3.67″. Class C, Table IV, represents a group of fifteen men with a threshold of 15 mm. and an average angle of 5.5″. Class D, Table V, is a record of a group of twenty-three men with a threshold of 20 mm. and an average parallactic angle of 7.30″. The remaining eight classes, E to M, recorded in Tables V-VII, were determined by the depth-difference thresholds ranging from 30 to 360 mm. These thresholds represent parallactic

TABLE I. BINOCULAR PARALLAX IN TERMS OF SECONDS OF ARC.

Inter p. d. in mm. Depth difference in millimeters when the nearer distance is 6000 mm.; e. g., 5 mm. represents the second object at 6005 mm.

	5	10	15	20	25	30	35	40	50	60	90	120	150	180	210	240	270	300	330	360
57.0	1.628″	3.255″	4.880″	6.505″	8.128″	9,737″	11.349″	13.005″	16.178″	19.389″	28.945″	38.405″	47.775″	57.054″	66.242″	75.343″	84.357″	93.286″	102.131″	110.893″
57.5	1.645	3.289	4.931	6.572	8.205	9.833	11.462	13.089	16.339	19.569	29.210	38.755	48.210	57.572	66.839	76.024	85.115	94.120	103.041	111.878
58.0	1.662	3.322	4.975	6.624	8.273	9.919	11.563	13.208	16.478	19.739	29.463	39.091	48.627	58.069	67.420	76.682	85.855	94.942	103.943	112.855
58.5	1.676	3.343	5.010	6.676	8.341	10.004	11.663	13.314	16.615	19.909	29.717	39.427	49.044	58.567	67.998	77.338	86.589	95.752	104.829	113.822
59.0	1.687	3.372	5.056	6.738	8.419	10.090	11.760	13.429	16.762	20.080	29.972	39.766	49.466	59.072	68.585	78.006	87.335	96.576	105.723	114.795
59.5	1.703	3.405	5.105	6.798	8.487	10.175	11.862	13.546	16.905	20.249	30.225	40.102	49.884	59.570	69.163	78.664	88.074	97.395	106.628	115.775
60.0	1.720	3.435	5.143	6.850	8.557	10.261	11.954	13.660	17.080	20.420	30.480	40.440	50.304	60.071	69.744	79.324	88.812	98.210	107.519	116.741
60.5	1.728	3.455	5.181	6.905	8.623	10.350	12.058	13.767	17.183	20.589	30.764	40.775	50.763	60.575	70.325	79.986	89.553	99.029	108.514	117.712
61.0	1.745	3.488	5.230	6.971	8.702	10.431	12.160	13.886	17.333	20.759	30.987	41.113	51.141	61.076	70.906	80.646	90.293	99.848	109.313	118.735
61.5	1.767	3.527	5.276	7.029	8.777	10.528	12.266	14.010	17.477	20.936	31.246	41.457	51.567	61.579	71.494	81.312	91.039	100.672	110.214	119.757
62.0	1.776	3.545	5.312	7.077	8.842	10.604	12,361	14.112	17.610	21.103	31.498	41.789	51.981	62.075	72.075	81.970	91.775	101.487	111.107	120.635
62.5	1.786	3.571	5.354	7.137	8.916	10.686	12.456	14.224	17.751	21.268	31.746	42.121	52.396	62.570	72.646	82.626	92.514	102.299	111.992	121.603
63.0	1.803	3.605	5.405	7.197	8.986	10.774	12.560	14.344	17.899	21.441	32.003	42.462	52.819	63.075	73.232	83.291	93.254	103.122	112.897	122.579
63.5	1.819	3.635	5.448	7.250	9.056	10.860	12.663	14.457	18.038	21.564	32.241	42.754	53.192	63.529	73.766	83.905	93.946	103.902	113.745	123.505
64.0	1.832	3.658	5.482	7.306	9.119	10.940	12.756	14.565	18.180	21.780	32.509	43.133	53.654	64.072	74.390	84.609	94.730	104.754	114.684	124.520
64.5	1.844	3.688	5.530	7.370	9.200	11.029	12.857	14.682	18.325	21.949	32.763	43.471	54.074	64.576	74.974	85.275	95.473	105.577	115.581	125.497
65.0	1.861	3.721	5.574	7.423	9.270	11.116	12.960	14.800	18.465	22.122	33.021	43.813	54.499	65.080	75.558	85.936	96.214	106.395	116.480	126.470
65.5	1.877	3.746	5.612	7.478	9.342	11.204	13.058	14.909	18.606	22.294	33.273	44.145	54.912	65.574	76.134	86.592	96.951	107.210	117.373	127.439
66.0	1.886	3.771	5.654	7.536	9.414	11.284	13.154	15.021	18.751	22.458	33.523	44.479	55.330	66.074	76.716	87.254	97.692	108.029	118.272	128.415
66.5	1.902	3.804	5.704	7.595	9.484	11.371	13.257	15.140	18.891	22,631	33.781	44.822	55.756	66.581	77.300	87.917	98.433	108.848	119.166	129.386
67.0	1.919	3.835	5.743	7.650	9.556	11.459	13.361	15.252	19.032	22.805	34.038	45.157	56.171	67.077	77.879	88.576	99.172	109.666	120.062	130.359
67.5	1.930	3.857	5.781	7.705	9.627	11.542	13.452	15.361	19.174	22.969	34.284	45.488	56.586	67.575	78.458	89.237	99.912	110.486	120.958	131.331
68.0	1.944	3.888	5.829	7.769	9.699	11.627	13.554	15.479	19.318	23.140	34.541	45.826	57.011	68.076	79.042	89.899	100.651	111.302	121.852	132.302
68.5	1.962	3.922	5.875	7.824	9.771	11.715	13.659	15.597	19.460	23.315	34.802	46.150	57.429	68.580	79.623	90.560	101.393	112,123	122.752	133.280
69.0	1.978	3.946	5.913	7.878	9.841	11.802	13.755	15.705	19.595	23.483	35.049	46.502	57.845	69.079	80.199	91.219	102.135	112.941	123.646	134.249
69.5	1.987	3.972	5.955	7.936	9.913	11.883	13.851	15.818	19.744	23.649	35.301	46.833	58.267	69.582	80.784	91.879	102.869	113.755	124.538	135.219
70.0	2.003	4.005	6.004	7.995	9.984	11.970	13.955	15.938	19.885	23.823	35.561	47.180	58.686	70.081	81.365	92.542	103.612	114.578	125.440	136.200
70.5	2.019	4.035	6.043	8.055	10.055	12.058	14.057	16.048	20.027	23.996	35.812	47.513	59.103	70.581	81.948	93.207	104.355	115.395	126.333	137.167
71.0	2.031	4.057	6.082	8.105	10.126	12.140	14.150	16.158	20.169	24.144	36.062	47.848	59.525	71.082	82.526	93.861	105.088	116.209	127.225	138.137
71.5	2.044	4.087	6.128	8.167	10.197	12.225	14.251	16.276	20.310	24.331	36.320	48.190	59.942	71.580	83.106	94.523	105.831	117.032	128.127	139.113
72.0	2.062	4.121	6.175	8.223	10.269	12.314	14.357	16.392	20.453	24.502	36.577	48.525	60.362	72.083	83.693	95.191	106.574	117.850	129.020	140.085
72.5	2.077	4.146	6.212	8.277	10.340	12.401	14.452	16.501	20.595	24.673	36.826	48.860	60.781	72.586	84.271	95.845	107.309	118,665	129.904	141.058

Note.—Each increase of 1 mm. in interpupillary distance gives an advantage of about 1.6%; i. e., the man with the 72.5 p. d. has an advantage of 15% over the man with the 63 mm. p. d.

angles ranging from 10.6″ to 136.2″ (2′ 6.2″).

THE BINOCULAR FINDINGS.

When we turn our attention to the question of determining the causes for the great difference in the binocular parallax as an individual factor we must refer to the other data such as visual acuity, muscle balance, etc. The tests which provided this data were carefully made by one examiner and the results obtained checked by another. All visual tests were made under the same condition of surface brightness and illumination. Ocular muscle balance was determined by the screen and parallax tests. The near point of convergence was taken from a vertical plane through the anterior foci of the two eyes but the record was corrected to read from the center of rotation of the eyeballs by adding 25 mm. to the first finding. The interpupillary distance was measured in millimeters by the infinity method, i. e., when the visual axes were parallel.

The results of the tests for the near point of accommodation, however, are unreliable because unfortunately they were obtained subjectively and as a consequence many of the findings are absurdly small. When we are reminded that the observers were all endeavoring to make their maximum showing it is easy to understand why a test for accommodation under such circumstances should not be subjective. Fortunately the other findings provide sufficient reasons for the individual difference in classification.

In examining the data of Class A we find not only a very high visual acuity but also, except for two cases, a perfect symmetry of visual acuity. The difference exhibited by the two exceptions is only that between 20/10 and 20/10— for one, and 20/15 and 20/15+ for the other. The average visual acuity of the fourteen men was 20/15+ in each eye. The lowest visual acuity was 20/20 O. U., which was found only in one observer. None of the men had ever worn a correction. Tests for muscle balance for distance revealed no hyperphoria. Eight men had orthophoria, and the other six from ½ to 3 prism diopters of esophoria. There was none with exophoria. The near point of convergence ranged from 63 to 100 mm. with an average of 83 mm., which is fully normal. The interpupillary distance averaged 66.14 mm., which is over the average. In brief, there were very high visual acuity, practically perfect visual symmetry and perfect muscle balance. These findings are the more significant after we examine the data of the other classes.

In Class B we find a little less visual acuity, more visual asymmetry and a few men with corrections; also a number of observers with small degrees of exophoria and with some hyperphoria; also a few men with a weak convergence for near. The interpupillary distance averaged about 2 mm. less than in Class A.

The other classes, C to M (See Tables IV to VII), show on the whole a steadily decreasing visual acuity and visual symmetry, more subjects wearing corrections and more cases of muscle imbalance.

There was another phenomenon. It was found that some men projected one rod nearer when actually it was the farther. This tendency began to show even in Class B, but became quite common in the lower classes. With some it appeared to be connected with a difference in the visual acuity of the two eyes. With others it seemed to be associated with some latent vertical or lateral deviation. Finally it appeared in a few observers to be the sole cause in reducing their power to judge distance. There was no uniformity as to the false projection of either the right or the left rod; one man might persistently project the left rod nearer and another man follow him immediately and strongly project the right rod nearer. It, therefore, cannot be explained by some fault in the method of testing. In fact there seems to be no adequate explanation of this phenomenon.

TABLE II. CLASSIFICATION OF OBSERVERS ACCORDING TO THEIR BINOCULAR PARALLACTIC ANGLE

Class A. (Those whose threshold is represented by a depth difference of 5 mm.)

No.	Name.	Age.	Army Service.	Hours Flying	Vision	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Correct judgment in 20 trials — Depth Differences: 30 mm.	20 mm.	15 mm.	10 mm.	5 mm.	Per cent Correct at 5 mm.	Binocular Parallactic Angle.
1.	W. O'T.	19	Chauffer Med. Dept.	....	R.20/10 L.20/10	Orth	85	65	63	20	20	20	20	15	75	1.803"
2.	C. B. W.	26	Aerial Observer	180	R.20/15+ L.20/15+	Eso 1½	120	63	63.5	20	20	20	20	16	80	1.819"
3.	O. A. B.	41	Med. Corps	....	R.20/15 L.20/15	Orth	150	70	63.5	20	20	20	18	16	80	1.819"
4.	T. L. O.	25	Pilot	150	R.20/10 L.20/10—	Eso ½	145	80	63.5	20	20	20	20	15	75	1.819"
5.	S. A. P.	28	Pilot	65	R.20/15— L.20/15—	Orth	120	95	64	20	20	20	18	16	80	1.832"
6.	A. H.	21	Pilot	60	R.20/15 L.20/15	Eso ½	100	95	66	20	19	18	18	17	85	1.886"
7.	S. V. T.	26	Pilot	100	R.20/15+ L.20/15+	Orth	110	95	66	20	20	19	18	16	80	1.886"
8.	D. R. S.	26	Pilot	300	R.20/15 L.20/15	Orth	R.115 L.105	65	66	20	19	18	18	15	75	1.886"
9.	W. R. D.	27	Pilot	500	R.20/20 L.20/20	Eso ½	90	90	66	20	20	19	20	15	75	1.886"
10.	J. N. L.	25	Pilot	150	R.20/10— L.20/10—	Orth	105	93	67	20	20	20	18	18	90	1.919"
11.	R. W. E.	23	Pilot	140	R.20/10— L.20/10—	Orth	97	75	67	20	19	19	19	16	80	1.919"
12.	W. A. B.	22	Pilot	200	R.20/15 L.20/15+	Eso 3	65	100	69	20	20	20	16	18	90	1.978"
13.	L. B. C.	21	Pilot	150	R.20/15— L.20/15—	Orth	95	100	69	20	20	20	19	17	85	1.978"
14.	O. G. H.	21	Pilot	400	R.20/20 L.20/20	Eso 1½	95	75	72.5	20	20	20	17	15	75	2.077"
	Average	25			O.U.20/15+	Eso ½	106	83	66	..	..	..	..	..	80	1.893"

TABLE III. CLASSIFICATION OF OBSERVERS CONTINUED.

Class B. (Those whose threshold is represented by a depth difference of 10 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer	Correct judgments in 20 trials—Depth Differences—30 mm.	20 mm.	15 mm.	10 mm.	5 mm.	Per cent Correct at 10 mm.	Binocular Paralactic Angle	Remarks.
15.	C. B.	13	School Boy	....	R.20/15+ L.20/15+	Eso 1	90	60	57	.....	20	20	17	16	11	80	3.255″	
16.	J. N. B.	44	Med. Corps	....	R.20/15 L.20/15	Orth	375	80	59.5	.....	20	20	17	18	8	90	3.405″	
17.	Thom.	33	Pilot	250	R.20/15 L.20/15	Orth	150	90	60	.....	19	16	15	15	12	75	3.435″	
18.	L. P. K.	29	Pilot	250	R.20/15— L.20/15—	Eso 1	90	105	61	Left	20	17	15	16	9	80	3.488″	Tendency to project L. rod nearer when the two rods are in same plane.
19.	H. L. L.	31	Pilot	175	R.20/10— L.20/10	Orth	75	96	62	.....	20	20	20	17	8	85	3.545″	
20.	D. L. J.	23	Pilot	50	R.20/20 L.20/20	Orth	85	75	62	.....	20	18	18	15	10	75	3.545″	
21.	A. R. T.	23	Pilot	75	R.20/10 L.20/10	Orth	115	90	62.5	.....	20	20	19	19	10	95	3.571″	
22.	L. C. A.	22	Pilot	50	R.20/15 L.20/15	Exo 1	80	75	62.5	.....	20	17	19	18	12	90	3.571″	
23.	H. H.	24	Pilot	80	R.20/15— L.20/15—	Eso ½	100	95	63	.....	20	20	17	19	11	95	3.605″	
24.	G. A. B.	22	Pilot	400	R.20/15 L.20/10	Exo 1½	73	88	63	.....	20	17	17	17	10	85	3.605″	
25.	R. W. S.	25	Pilot	200	R.20/15+ L.20/15+	Exo 1½	95	90	63	.....	20	18	19	16	8	80	3.605″	
26.	J. C. R.	23	Pilot	500	R.20/15 L.20/15	Orth	107	85	63	.....	20	20	20	17	13	85	3.605″	
27.	G. C. F.	22	Pilot	31	R.20/15 L.20/15	Orth	98	100	63	.....	20	20	15	16	14	80	3.605″	
28.	H. C. S.	25	Pilot	140	R.20/15— L.20/15—	Exo ½	105	125	63	.....	20	20	20	15	7	75	3.605″	
29.	J. T. D.	23	Med. Corps	....	R.20/15+ L.20/15—	Exo 1	90	75	63.5	.....	20	19	18	16	8	80	3.635″	Wearing moderate myopic correction. Vision excellent and practically equal.
30.	C. T. F.	23	Pilot	200	R.20/15 L.20/15	Eso ½	R 130 L 115	65	64.5	.....	20	20	17	18	10	90	3.688″	
31.	P. W. C.	45	Med. Corps	....	R.20/15 L.20/15	Exo ½ L.H. ½	325	100	64.5	.....	20	20	18	15	12	75	3.688″	Wearing mixed astigmatic correction. Vision excellent and symmetrical.
32.	J. H. Mc.	26	Pilot	70	R.20/15— L.20/15	Eso ½	110	95	65	Right	20	20	20	17	8	85	3.721″	Tendency to project R. rod nearer when the two rods are in same plane.
33.	E. G.	26	Pilot	95	R.20/20 L.20/20	L.H. 1	92	82	65	.....	20	18	15	16	12	80	3.721″	
34.	W. C. S.	26	Pilot	90	R.20/15 L.20/15	Orth	95	85	65.5	.....	20	20	17	19	9	95	3.746″	
35.	H. Mac.	23	Pilot	100	R.20/15 L.20/15	Eso 2 R. H. ½	120	100	66	.....	20	19	18	19	11	95	3.771″	
36.	H. C.	27	Pilot	70	R.20/15 L.20/15	Orth	100	70	66	.....	20	20	20	15	13	75	3.771″	
37.	W. S. R.	24	Pilot	100	R.20/15 L.20/15	Orth	105	85	66.5	.....	20	19	17	16	12	80	3.804″	
38.	C. L. P.	23	Pilot	50	R.20/15 L.20/15	Orth	95	110	67	.....	20	20	19	16	7	80	3.835″	
39.	B. B.	22	Pilot	250	R.20/15 L.20/15	Eso 1	97	85	67	Left.	20	20	15	15	8	75	3.835″	Tendency to project L. rod nearer when the two rods are in same plane.
40.	E. H.	33	Med. Corps	....	R.20/20 L.20/15	Orth	165	115	67	.....	20	20	16	15	9	75	3.835″	
41.	J. M. W.	39	Med. Corps	....	R.20/15 L.20/15	Exo 3	140	60	67	.....	18	19	18	15	12	75	3.835″	Wearing myopic correction. Vision excellent and symmetric.
42.	A. W. M.	23	Pilot	300	R.20/15 L.20/10—	Eso 2	70	85	69	.....	20	19	19	17	12	85	3.946″	
43.	T. J. V.	24	Pilot	300	R.20/20— L.20/10—	Exo ½	75	65	70	.....	20	20	16	15	11	75	4.005″	
44.	W. K. D.	22	Pilot	185	R.20/15— L.20/15	Eso ½	96	85	71	Right	20	18	17	15	5	75	4.057″	Tendency to project R. rod nearer when the two rods are in same plane.
	Average	26.2			O.U.20/15	Orth	118	87	64.3	.....	..	..	..	..	..	82.2	3.678″	

43.	T. J. V.	24	Pilot	300	L.20/10—	Exo ½	75	65	70	.....	20	20	16	15	11	75	4.005"	
44.	W. K. D.	22	Pilot	185	R.20/15— L.20/15	Eso ½	96	85	71	Right	20	18	17	15	5	75	4.057"	Tendency to project R. rod nearer when the two rods are in same plane.
	Average	26.2			O.U.20/15	Orth	118	87	64.3	.....	..	..	..	..	..	82.2	3.678"	

TABLE IV. CLASSIFICATION OF OBSERVERS CONTINUED.

Class C. (Those whose threshold is represented by a depth difference of 15 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer	Correct judgments in 20 trials—Depth Differences 40 mm.	30 mm.	20 mm.	15 mm.	10 mm.	Percent Correct at 15 mm.	Binocular Paralactic Angle	Remarks.
45.	H. J. H.	39	Med. Corps	....	R.20/10 L.20/10	Eso ½	145	70	59	.....	20	20	20	15	10	75	5.056"	Wearing high correction for compound hyperopic astigmatism.
46.	J. D. C.	23	Pilot	125	R.20/15 L.20/15	Orth	142	100	60	.....	20	16	19	15	11	75	5.143"	
47.	P. A. W.	26	Pilot	15	R.20/15 L.20/20	Orth	102	92	61	Right	20	18	16	16	12	80	5.230"	Wearing high mixed astigmatic correction.
48.	E. B. G.	38	Med. Corps	....	R.20/15 L.20/15	Eso 2	145	60	62.5	.....	20	20	20	16	14	80	5.354"	Projects R. rod nearer. Vision better in right eye.
49.	E. L. H.	24	Pilot	200	R.20/15 L.20/10	Exo 1	R 110 L 102	100	64	Left	20	17	18	16	13	80	5.482"	Projects L. rod nearer. Vision better in left eye.
50.	H. M. J.	34	San. Corps	....	R.20/15 L.20/15	Orth	150	95	64.5	.....	20	20	17	16	11	80	5.530"	See note below.
51.	L. H. B.	31	Med Corps	....	R.20/15 L.20/15	R.H. ½	150	108	64.5	.....	20	20	20	15	13	75	5.530"	Convergence power below normal.
52.	C. K.	23	Med. Corps	....	R.20/15 L.20/15	Exo 1½	R 90 L100	85	65	.....	20	20	18	18	9	90	5.574"	Wearing correction for compound myopic astigmatism.
53.	E. L. S.	22	Pilot	100	R.20/15 L.20/15	Eso 1	95	85	66	.....	20	20	18	17	13	85	5.654"	Projects left rod nearer.
54.	W. G. B.	23	Pilot	100	R.20/15 L.20/15	Eso ½	90	100	66	.....	20	20	20	16	11	80	5.654"	Excessive exophoria for near.
55.	E. A. B.	28	Pilot	200	R.20/15 L.20/15	Eso ½	110	90	66	Left.	20	20	20	15	13	75	5.654"	
56.	E. W. K.	27	San. Corps	....	R.20/15 L.20/15	Exo 1 Exo' 12	130	90	66	.....	20	20	19	15	13	75	5.654"	
57.	W. S. P.	26	Pilot	150	R.20/15 L.20/15	Eso 1	115	95	67	.....	20	20	19	16	9	80	5.743"	
58.	R. W. P.	23	Pilot	200	R.20/15 L.20/15	Eso ½	120	130	68	.....	20	19	19	16	11	80	5.829"	Has weak convergence.
59.	H. W. R.	24	Pilot	150	R.20/30 L.20/30	Eso ½	70	65	70	.....	20	15	16	16	10	80	6.004"	Thinks his low vision due to excessive smoking.
	Average	27.4			R.20/15 L.20/15	Eso 1/5	118	91	65.6	.....	..	..	..	..	..	79.3	5.540"	

Note:—Case No. 50 was the first subject experimented upon. The next day the effect of the shutter was discovered. A subsequent test of this man, who was a most careful observer, put him in Class A when shutter was used.

Among the less efficient classes there were three or four observers whose poor showing could not be explained on any of the data recorded. One of these however was suspected at the time of his test of not giving his conscientious cooperation, and two others admitted at the beginning of the test that they were very tired from lack of sleep.

It seems, therefore, from a study of the data in Tables II to VII that there are physical reasons for the marked individual variations in the ability of the binocular parallax to judge distance. Furthermore, that it is possible by means of an apparatus smilar to the one used here to eliminate those candidates whose judgment of distance is below normal and also to classify the normal observers into several groups according to their degree of excellence.

To determine what should be called a "normal" or "not normal" in the judgment of distance is a very difficult proposition. It is decidedly a relative matter especially when an examination affords a classification as this one does. A careful study of the data, however, convinces me that a break occurs between the 20 and 30 mm. depth-differences. Beyond the 20 mm. station there seems to be a physical cause for a poor showing in almost every case. With some it was visual asymmetry or some muscle imbalance. With others there was a persistent tendency to project one image nearer. Or it may be that the subject was wearing a high correction. Another thing is noted, i. e., the great majority of the flyers fell into the first four groups. This latter explanation may seem like an empirical one, so I take this opportunity to state what I should have liked to include in the tables, viz., that I took every opportunity possible to question the flyers upon their training, their accidents if any, and to obtain their opinions as to the importance of certain visual factors. Therefore basing my conclusions upon all the facts at my disposal, both those recorded and those unrecorded, I feel justified in recommending as normal a binocular parallactic angle not greater than 8.0″, when the test is made with an apparatus made on the principles of the one used in these experiments.

An important feature of the test is the use of the screen or shutter. Lifting this quickly gives a sudden impression of the rods which is more accurate than is a delayed impression. In fact most of our every day depth judgments are made instantaneously or practically so. During the war, balloon observers in training were required to make instantaneous judgments of distance in spotting shell bursts near targets. Of course in this case linear perspective aided them greatly. An aviator recently told me he was convinced that the success of the great aces was largely due to the fact that they made instant decisions. It would seem then that accurate determination of not only visual but also depth perception reaction times would be of great value.

This last mentioned phase of the subject is made the more complex when we reflect that the flyer must not only judge his distance accurately, but also his speed. More properly therefore the whole subject might with profit be approached from the view point of trying to discover the correlation between judgment of distance and of speed. A priori it would seem that those flyers possessing very quick reaction times as well as small binocular parallactic angle thresholds should be able to give the best performances.

ACCESSORY DATA.

A. **Monocular Judgment of Distance.**

Our ability to judge distance with only one eye depends upon two things:

1. Terrestrial association.
2. Size of the retinal image, but this only when we recognize the object fixated or its association with some other object we know from experience.

In order to be able either to confirm or to refute the opinion expressed by some that the loss of an eye by an aviator should not necessarily disqualify him from further flying, I examined ten men for the purpose of learning their ability to judge distance monocularly. Nine of these men had already

TABLE V. CLASSIFICATION OF OBSERVERS CONTINUED.

Class D. (Those whose threshold is represented by a depth difference of 20 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer	Correct judgments in 20 trials—Depth Differences—40 mm.	30 mm.	20 mm.	15 mm.	10 mm.	Percent Correct at 20 mm.	Binocular Paralactic Angle.	Remarks.
60.	E. B.	12	School Boy	....	R.20/15 L.20/15—	Eso ½	82	75	58.5	.....	20	20	19	13	11	95	6.676″	
61.	H. A. G.	26	Pilot	300	R.20/15 L.20/15	Exo 2 Exo′ 9	108	95	59.5	.....	20	19	20	13	7	100	6.798″	Excessive exophoria both for near and distance.
62.	N. S. A.	24	Pilot	300	R.20/15 L.20/15	Orth	100	60	60	.....	20	20	17	11	8	85	6.850″	
63.	R. K. H.	23	Pilot	....	R.20/15+ L.20/15+	Orth	100	85	60	.....	20	19	15	9	9	75	6.850″	
64.	C. P. M.	22	Pilot	175	R.20/15 L.20/15	Orth	95	70	61	.....	20	18	15	10	13	75	6.971″	
65.	R. J. H.	24	Pilot	200	R.20/15 L.20/15	Exo 1½ Exo′ 10	100	155	62	Left	20	20	18	7	11	90	7.077″	Projects left rod nearer. Has very weak convergence.
66.	N. B. L.	26	Observer	60	R.20/15 L.20/15	Exo ½	127	88	62	Left	20	20	16	12	11	80	7.077″	Projects left rod nearer.
67.	C. B. T.	31	Pilot	150	R.20/20+ L.20/20	Eso ½	102	85	63	.....	20	17	15	12	13	75	7.197″	
68.	G. A. Y.	32	Pilot	....	R.20/15 L.20/15	Eso 1	120	75	63	Right	20	17	15	11	12	75	7.197″	Projects right rod nearer.
69.	H. R. C.	26	Pilot	100	R.20/20— L.20/20—	Eso 1	85	90	63.5	.....	19	16	16	13	12	80	7.250″	
70.	E. B. M.	22	Pilot	60	R.20/15 L.20/15+	Exo 4 Exo′ 12	100	175	64	.....	20	18	16	7	8	80	7.306″	Excessive exophoria and very weak convergence.
71.	J. L. J.	30	Pilot	175	R.20/15— L.20/15—	Orth	115	85	65	Left	20	20	18	5	7	90	7.423″	Projects left rod nearer.
72.	W. H. P.	24	Pilot	400	R.20/15— L.20/15	Eso ½	85	90	65	.....	20	18	18	13	11	90	7.423″	
73.	G. B. B.	25	Pilot	165	R.20/15— L.20/15—	Eso 1½ R.H. 1	95	80	65	Left	20	20	16	8	13	80	7.423″	Tendency to project left rod nearer. Has a latent vertical deviation.
74.	H. S. S.	22	Pilot	60	R.20/15 L.20/15	Eso 5	95	92	65	.....	20	20	16	6	8	80	7.423″	Excessive exophoria for distance.
75.	M. A. M.	31	Pilot	250	R.20/20— L.20/30	Exo 2	110	80	65	Right	20	20	15	8	11	75	7.423″	Projects right rod nearer. Vision not normal and not symmetrical.
76.	C. M. S.	23	Pilot	80	R.20/15— L.20/15	Orth	115	90	65	Left	20	19	15	8	6	75	7.423″	Projects left rod nearer.
77.	J. J. V.	24	Pilot	200	R.20/15— L.20/15—	Orth	85	80	66.5	.....	20	20	15	12	7	75	7.595″	
78.	H. M. H.	24	Pilot	160	R.20/10— L.20/10—	Eso ½	98	50	67	Left	20	18	17	16	13	85	7.650″	Projects left rod nearer.
79.	J. H. V.	29	Balloon Observer	150	R.20/15 L.20/15	Eso ½	110	50	67	.....	20	20	16	11	12	80	7.650″	No sleep the previous night. Gave conscientious assistance in test but stated he was too tired to do well.
80.	B. L. W.	56	Med. Corps	....	R.20/15+ L.20/15+	Eso 4	310	75	67	.....	20	15	16	10	9	80	7.650″	Wearing hyperopic and presbyopic corrections. Accommodation taken without near correction.
81.	D. C. M.	25	Pilot	....	R.20/15 L.20/15	Eso 1	75	50	67	.....	20	19	15	14	10	75	7.650″	
82.	R. E.	24	Pilot	125	R.20/15 L.20/15—	Eso 3 Eso′ 10	65	60	71	.....	15	16	16	14	8	80	8.105″	Has had marked asthenopic symptoms recently. Examination showed mixed astigmatism.
	Average	26.3			O.U.20/15—	Eso ⅜	108	83	64	.....	..	..	..	..	..	81.5	7.308″	

Note.—Phoria for near has only been recorded when abnormal Near findings are designated by the prime sign, e. g., Exo′ 12.

TABLE VI. CLASSIFICATION OF OBSERVERS CONTINUED.

Class E. (Those whose threshold is represented by a depth difference of 30 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	Correct judgments in 20 trials—Depth Differences—50 mm.	40 mm.	30 mm.	20 mm.	15 mm.	Percent Correct at 30 mm.	Binocular Paralactic Angle.	Remarks.
83.	W. W. M.	26	Pilot	....	R.20/20—L.20/15	Orth	84	65	62	Right	16	15	15	10	..	75	10.604″	Projects right rod nearer. Very erratic, easily fatigued. Loss of sleep several nights.
84.	C. T.	26	Pilot	170	R.20/15+ L.20/15+	Orth	120	65	62.5	Left	20	18	15	6	..	75	10.686″	Strong tendency to project left rod nearer.
85.	C. P. H.	31	Pilot	....	R.20/15— L.20/15—	Exo 5 L.H. ½	190	90	63	.....	..	20	19	13	11	95	10.774″	Has muscle imbalance.
86.	E. W. D.	41	Med. Corps	....	R.20/15 L.20/15	Eso 2	105	80	64	.....	..	20	16	11	12	80	10.940″	Wearing high hyperopic correction.
87.	J. H.	28	Med. Corps	....	R.20/15 L.20/15	Exo 1	135	67	64.5	.....	..	20	17	11	8	85	11.029″	Wearing high hyperopic correction.
88.	E. C.	47	San. Corps	....	R.20/20— L.20/20+	Exo 1 L.H.1	R170 L160	90	64.5	.....	18	19	16	12	8	80	11.029″	Wearing myopic correction. Has latent vertical deviation.
89.	P. D.	43	Med. Corps	....	R.20/10 L.20/10	Exo 2	185	55	65.5	.....	..	20	16	12	10	80	11.204″	Wearing astigmatic correction.
90.	J. D. G.	37			R.20/15— L.20/15—	Exo 2 R.H.½	155	115	67	.....	..	20	18	13	13	90	11.459″	Has weak convergence.
91.	J. D. B.	29	Med. Corps	....	R.20/10— L.20/10—	Orth	110	90	67	Right	..	20	16	7	..	80	11.459″	Projects right image nearer. Wearing high correction for hyperopic astigmatism.
92.	J. R. C.	21	Pilot	100	R.20/20+ L.20/20—	Eso 1	90	80	69	Left	..	20	17	12	7	85	11.802″	Strong tendency to project left rod nearer.
	Average	32.9			R.20/15— L.20/15	Exo 4/5	134	80	65	.....	..	..	..	..	..	82.5	11.099″	

Class F. (Those whose threshold is represented by a depth difference of 40 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	Correct judgments in 20 trials—Depth Differences—50 mm.	40 mm.	30 mm.	20 mm.	15 mm.	Percent Correct at 40 mm.	Binocular Paralactic Angle.	Remarks.
93.	C. J. R.	52	San. Corps	....	R.20/40+ L.20/30	Exo 1	190	100	65	.....	20	18	12	14	11	90	14.800″	Wearing correction but vision not normal and not symmetric.
94.	G. C. P.	30	Pilot	300	R.20/30— L.20/30—	Exo ½	75	100	66	.....	20	16	13	11	..	80	15.021″	Vision not normal but equal in the two eyes. Had no serious landing trouble.
95.	L. E. B.	30	Balloon Observer	100	R.20/30 L.20/15	Exo 1½	R165 L192	100	69	Left	20	17	10	..	..	85	15.705″	Projcts L. rod nearer. Considerable uncorrected hyperopia. Vision better in left eye.
	Average	37			R.20/30— L.20/20—	Exo 1	147	100	67	.....	..	..	..	..	..	85	15.175″	

TABLE VII. CLASSIFICATION OF OBSERVERS CONTINUED.

Class H. (Those whose threshold is represented by a depth difference of 60 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	Correct Judgments in 20 trials — Depth Differences — 90 mm.	60 mm.	50 mm.	40 mm.	30 mm.	Percent Correct at 60 mm.	Binocular. Paralactic Angle.	Remarks.
96.	H. F. H.	24	Pilot	300	R.20/30—L.20/20—	Eso ½	95	110	62	.....	..	20	13	16	8	100	21.103″	Slightly myopic. Vision not symmetric. Has weak convergence.
97.	E. W. D.	41	Med. Corps	....	R.20/30 L.20/30	Eso 2	105	80	64	.....	..	20	11	..	..	100	21.780″	Same case as No. 86, but with vision uncorrected.
98.	P. W. C.	45	Med. Corps	....	R.20/50 L.20/50+	Exo ½ L.H. ½	325	100	64.5	.....	20	16	11	..	..	80	21.949″	Same case as No. 31, but with vision uncorrected.
99.	J. M. W.	39	Med. Corps	....	R.20/50 L.20/50	Exo 3	140	60	67	.....	..	20	..	..	..	100	22.805″	Same case as No. 41, but with vision uncorrected.
	Average	37.3			R.20/40 L.20/40+	Exo ¼	166	88	64.4	.....	..	..	..	..	..	95	21.909″	

Class I. (Those whose threshold is represented by a depth difference of 90 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	150 mm.	120 mm.	90 mm.	60 mm.	50 mm.	Percent Correct at 90 mm.	Binocular. Paralactic Angle.	Remarks.
100.	P. F. O.	28	Pilot	150	R.20/30+ L.20/30+	Eso ½	100	50	62	Left	20	19	16	14	8	80	31.498″	Very strong tendency to project left rod nearer. Vision not normal but equal.
	Average	Same as above.																

Class J. (Those whose threshold is represented by a depth difference of 120 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	120 mm.	90 mm.	60 mm.	50 mm.	Percent Correct at 120 mm.	Binocular. Paralactic Angle.	Remarks.
101.	V. T. S.	30	Med. Corps	....	R.20/70 L.20/200	Eso 1	145	160	69	.....	20	17	14	10	8	85	46.502″	Highly myopic; not corrected.
	Average	Same as above.																

Class K. (Those whose threshold is represented by a depth difference of 180 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	180 mm.	150 mm.	120 mm.	90 mm.	60 mm.	Percent Correct at 180 mm.	Binocular. Paralactic Angle.	Remarks.
102.	J. M. W.	39	Med. Corps.	....	R20/200 L.20/200	Exo 3	140	60	67	.....	18	..	..	..	..	90	67.077″	Same case as Nos. 31 and 98. Left eye alone corrected to make vision symmetric.
103.	A. B. H.	26	Pilot	120	R.20/15—L.20/15—	Eso 3	102	70	71	Left	20	14	12	10	13	100	71.082″	Strong tendency to project L rod nearer. Single binocular vision for near, but intermittent for distance.
	Average	32.5			O.U.20/50—	Orth	121	65	69	.....	..	..	..	..	..	95	69.079″	

Class L. (Those whose threshold is represented by a depth difference of 270 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	300 mm.	270 mm.	240 mm.	210 mm.	180 mm.	Percent Correct at 270 mm.	Binocular. Paralactic Angle.	Remarks.
104.	W. T. G.	39	A. S. Non-Flier	....	R.20/50+ L.20/15	Eso 4	R250 L185	80	64	Right	20	18	12	16	8	90	94.730″	Small central relative scotoma R. E. Strong tendency to project right rod nearer. Vision not symmetric.
	Average	Same as above.																

Class M. (Those whose threshold is represented by a depth difference of 360 mm.)

No.	Name.	Age.	Army Service.	Hours Flying.	Vision.	Muscle Balance.	N.P. Accom.	N.P. Conv.	Inter P.D.	Image Projected Nearer.	360 mm.	240 mm.	180 mm.	Percent Correct at 360 mm.	Binocular. Paralactic Angle.	Remarks.
105.	J. M. W.	39	Med Corps	....	R.20/200 L.15/200	Exo 3	140	60	67	.....	16	..	..	80	130.359″	Same case as Nos. 31, 98 and 102, but with vision wholly uncorrected.
106.	S. E. G.	55	Med. Corps	....	R.20/200 L.20/100	.....	..	..	70	.....	16	12	10	80	136.200″	Myopic test made without correction.
	Average	42			R.20/200 L.20/200—	.....	..	..	68.5	.....	..	..	..	80	133.280″	

been examined by the binocular test. The tenth man was an aviator who had lost one eye thru an accident. The result of these tests are recorded in Table X. The same apparatus was used for both the binocular and monocular tests, so the results are comparable. In the former test it was accepted tentatively at least, that not more than two factors, the binocular parallax and the retinal image, operated in the depth-difference determinations, whereas in the monocular test the difference in size of the retinal images or visual angles of the two rods was the only determining factor. From the data of Table X, it is noted that the average depth-difference representing the first recognition of an inequality of the two rods was 250 mm. According to computation derived from Table VIII, this distance represents a difference in visual angle of 0.23′ or 13.8″. The average monocular threshold depth difference, however, is somewhat larger. From the same table we find it to be at least 285 mm. which represents a visual angle difference threshold of 0.26′ or 15.5″. By referring to the records showing the binocular ability of the nine men we find that their average binocular threshold was represented by a depth-difference of only 14.4 mm., or by a binocular parallactic angle of 5.3″. This is about one-third the size of the visual angle required for the monocular test. If however, we compare the depth-difference thresholds we find that the binocular ability is twenty times that of the monocular. In other words, according to this conventional test, the binocular parallactic ability is twenty times more valuable as a determining factor in the judgment of distance than the best discrimination recognizable by the retinal image.

From the results obtained by the binocular and monocular tests it is evident that the apparatus altho devised to eliminate all factors except the binocular parallax and the visual angle, actually eliminates everything except the binocular parallax when the test is made with both eyes.

Another important distinction was revealed by the test, and that is, judgment with monocular observation is very slow. One must carefully study the object and surrounding data while binocular judgment is practically instantaneous.

Monocular vision is also very liable to a "reversal" deception, e. g., a valley may appear in perspective as a hill or vice versa. In case of a wrong interpretation by a one-eyed aviator trying to land, his disillusionment might easily come too late. On the other hand binocular single vision may be deceived only when the depth-difference is less than that which subtends the individual's least binocular parallactic angle. What would at first thought appear to be an exception in the case of binocular vision, and which

TABLE VIII. VARIATIONS IN THE VISUAL ANGLE SUBTENDED BY A 10 mm. ROD AT DIFFERENT DISTANCES.

Distance in mm.	Angle in minutes
6000.	5.730
6005.	5.725
6010.	5.720
6015.	5.715
6020.	5.710
6030.	5.701
6040.	5.691
6050.	5.682
6060.	5.673
6090.	5.645
6120.	5.617
6150.	5.590
6180.	5.563
6210.	5.536
6240.	5.509
6250.	5.500
6270.	5.483
6285.	5.470
6300.	5.457
6330.	5.431
6360.	5.405

TABLE IX. SIZE OF OBJECT REQUIRED TO MAINTAIN A VISUAL ANGLE OF 5.73 MINUTES AT THE FOLLOWING DISTANCES:

Distance in mm.	Size of object in mm.
6000.	10.000
6005.	10.008
6010.	10.017
6015.	10.025
6020.	10.033
6030.	10.050
6040.	10.067
6050.	10.083
6060.	10.100
6090.	10.150
6120.	10.200
6150.	10.250
6180.	10.300
6210.	10.350
6240.	10.400
6250.	10.417
6270.	10.450
6285	10.475
6300.	10.500
6330.	10.550
6360.	10.600

renders it almost as helpless as monocular, occurs when the distance to an absolutely flat surface with no associated objects within the visual field is to be judged, like the distance from an aeroplane to the surface of a perfectly calm sea. In this instance, however, the problem is reduced purely to the judgment of absolute distance with no relative distance criteria to assist. In other words there is no depth-difference to be judged when there is apparently only one distance.

B. Judgment of relative and absolute distance.

Some one may offer the criticism that with this apparatus the applicant is asked to perform a test for judgment of relative distance when the aviator's chief problem is absolute distance. The answer to this is that correct judgment of the latter depends upon the summation of a series or succession of judgments for relative distance, i. e., our eyes instinctively and unconsciously travel back and forth from one associated object to another over the interval to be judged, perhaps not only once but several times before our judgment of absolute difference is made. The best example to prove this is the great error made by untrained observers in judging distance on the water.

C. Night Landings.

A difficulty similar to landing upon a calm sea arises in making night landings. There is a lack in the necessary visual- and depth-difference contrasts. The Navy Department recognized this difficulty and several months ago devised an instrument to overcome it. According to a statement in Aerial Age Weekly of February 24, 1919, "The naval night altitude indicator consists of four spot lights whose rays are projected downward from the fuselage at such an angle that when the altitude of fifty feet is reached the two right and two left beams meet, forming a single spot on the ground. As the plane drops to a still lower altitude the beams again diverge, thus indicating the approximate distance from the ground. With a little practice the aviator is enabled to make very accurate landings with the assistance of this device."[30]

D. The Projection of Objects Horizontally superimposed.

A test was made on several men to

TABLE X. MONOCULAR JUDGMENT OF DISTANCE USING SIX METER STEREOSCOPE.

(Judgment was made by the difference in size of the retinal images of the two rods.)

No.	Name.	Age.	Vision.	Correct judgments at the following depth differences: 180 mm.	210 mm.	240 mm.	270 mm.	300 mm.	First noted one rod larger when depth difference was	Monocular Threshold	Represents visual angle difference of	Binocular Threshold	Represents binocular parallactic angle of
1.	I. N. B.	44	R.20/15	....	50%	90%	100%	.....	210 mm.	240 mm.	13.2"	10 mm.	3.4"
2.	H. M. J.	34	R.20/15	40%	60%	70%	90%	.....	240 mm.	240 mm.	13.2"	5 mm.	1.9"
3.	P. D.	43	R.20/10	55%	35%	65%	70%	95%	210 mm.	270 mm.	14.7"	30 mm.	11.2"
4.	K. C.	23	R.20/15	40%	....	50%	....	100%	240 mm.	300 mm.	16.4"	15 mm.	5.6"
5.	E. C.	47	L.20/20	40%	50%	60%	....	100%	240 mm.	300 mm.	16.4"	30 mm.	11.0"
6.	E. E.	33	R.20/15	60%	60%	30%	....	90%	210 mm.	300 mm.	16.4"	10 mm.	3.8"
7.	E. P.	38	R.20/15	....	....	60%	....	70%	300 mm.	300 mm.	16.4"	15 mm.	5.3"
8.	C. H.	46	R.20/15	40%	50%	39%	35%	40%	270 mm.	Over 300 mm.	Over 16.4"	10 mm.	3.7"
9.	W. G.	41	R.20/15	....	30%	....	50%	60%	270 mm.	Over 300 mm.	Over 16.4"	5 mm.	1.8"
10.	C. R.	20	L.20/20	50%	....	45%	....	65%	300 mm.	Over 300 mm	Over 16.4"	R. Eye Blind.....	
	Average	37	20/15	48%	48%	58%	69%	77.5%	250 mm.	Over 285 mm.	Over 15.5"	14.4 mm.	5.3"

determine their ability to judge which of the two rods was nearer when the apparatus was turned over on its side, thereby putting the rods in a horizontal position. In doing this the advantage of the binocular parallax was entirely lost and, as was to be expected, the judgment of the relative position of the horizontal rods was no better with two eyes than with one, and was reduced solely to the one factor, viz., the size of the retinal images. A recent aeroplane accident serves as a practical illustration of this inability to judge horizontal objects especially when they are suspended in the air with no linear parallax and other terrestrial association factors to help. During the Fifth Liberty Loan campaign an aviator was flying a captured Fokker as a member of the U. S. flying circus. He attempted to make a landing in a field in Cincinnati. His approach was at right angles to and over two sets of telegraph and telephone wires. He flew close to the ground intending to zoom over the wires and then drop down into the field. What actually happened was that he tore down both sets of wires, broke down a large pole and crashed. If the flyer had realized the difficulty of accurately projecting or judging the distance of horizontal wires with only the sky as a background, he probably would not have attempted the feat.

CONCLUSIONS.

1. Of all the personal factors which aid us in the judgment of distance, the binocular parallax is the most important. By experiment it was found to possess twenty times the ability of the retinal image or visual angle which is the important factor in monocular judgment. This however should not represent the comparative depth judgment skill of two and one-eyed persons, because in actual life the extraneous factors by helping both equally, serve greatly to lessen the difference in ability of the respective personal factors.

2. The minimal binocular parallactic angle varies greatly with individuals. It depends upon such factors as visual acuity, equality of visual acuity or visual balance, muscle balance, interpupillary distance, and probably some innate and acquired ability.

3. Fourteen observers (twelve of whom were pilots) out of one hundred and six examined were found to possess judgment of distance to a remarkable degree. Their binocular parallactic angles ranged from 1.8″ to 2.0″ with an average of 1.89″.

4. To possess normal judgment of distance one's binocular parallactic angle should not be greater than 8.0″ when the test is performed with an apparatus made on the principles of the one used for these experiments. This includes classes A, B, C and D of this experiment (See Tables II to V).

5. An apparatus like the one used in this experiment is free from the criticism of the hand stereoscope. Furthermore, it permits of classification of individuals according to their discriminating ability. In view of the different requirements in various forms of military aviation it would be an advantage to be able to assign successful applicants to special training according to their different degrees of ability.

6. The value of such an apparatus is greatly enhanced and much smaller discriminations are possible by giving the observer a sudden impression of the objects to be judged. Otherwise there is apt to be a disconcerting fluctuation of those objects. Most of our natural binocular judgments are more or less instantaneous. Therefore the shutter on the apparatus is an important requirement.

7. The binocular parallax operates in the judgment of objects maintaining some horizontal or lateral separation, but not for superimposed objects like telegraph wires. In the latter instance judgment is dependent upon the interpretation of the retinal images when all factors extraneous to the individual like terrestrial association and aerial perspective are excluded.

8. To estimate correctly the position of an object one must know its

direction and distance. Direction is judged more accurately with one eye but distance better with both. To be denied the privilege of using either one or two eyes at will would be a distinct disadvantage to an aviator.

9. The reaction time required to make monocular judgments of distances is very slow, whereas binocular judgments are practically instantaneous.

10. A tendency to project one image nearer than the other was found in 23 out of the 105 subjects. Some showed this tendency to a marked degree. Altho some of these cases had muscle imbalance, others visual asymmetry, and still others had both these abnormal conditions, the phenomenon cannot be explained satisfactorily.

11. The wide variations in the visual angle and binocular parallactic angle thresholds according to the experiments herein recorded make it evident that the two angles have nothing to do with each other. It is a mistake therefore to assume because the cones in one's retina are limited to a certain distance apart, that one's binocular parallactic angle must necessarily be limited to the size of the visual angle representing that distance.

12. The effect of low oxygen on the depth perceiving sense is of little importance because, at the critical time during the flight, which is the landing, there is no lack of oxygen.

RELATION OF THE OCULAR MUSCLES AND SCLERA IN THE ETIOLOGY OF MYOPIA.

S. Ochi, M. D.

KYUSHU, JAPAN.

This paper discusses probable factors in the etiology of myopia, and reports experiments bearing on the influence of compression upon the development of the eyeball.

There are many hypotheses concerning the genesis of myopia, which I will not repeat here. I wish only to call attention to the relation of the ocular muscles and sclera to myopia as indicated by my experiments.

I. Ocular Muscles and Sclera. All vertebrates (except myxinoids) have four recti muscles and two obliques, inserted on the eyeball. Some vertebrates have in addition a retractor bulbi, which is found in most forms from the amphibia upwards, but does not exist in man and monkeys.

The ocular muscles have the movement of the eyeball as their principal function; but that they may serve other purposes also is indicated by the fact that the ocular muscles of some animals are excessively developed in comparison with the size of their eyeballs. For example, the ocular muscles of the whale are of enormous size. Therefore Weber[1] suggested that such excessively developed muscles might serve as an elastic cover to protect the eye. But Pütter[2] said that the strongly developed ocular muscles may serve to keep the eye warm. Tho the physiologic function of the ocular muscles may not always be so simple, it can be easily understood that the eyeball-wall can undergo some pressure by the contraction of the ocular muscles; and if the muscles are strongly developed, the compression of the eyeball must be greater.

The sclera of vertebrates is composed of fibrous tissue, cartilage and bone. But that of mammals contains no cartilage or bone, except in the monotremes, which retain cartilage in the sclerotic coat. The thickness of the sclerotic coat varies with the species, and moreover its thickness varies in different parts of the same eyeball being thick in some parts, while thin in others. We know that the eye of the whale has a very thick sclerotic coat. Weber[1] explained this fact as

due to the resistance of the sclera against hydrostatic pressure. But the sclerotic coat of the whale is especially thick in the back of the eyeball. If its resistance against the hydrostatic pressure is the only reason for the thickness of the sclera, then the wall of the eyeball should be as thick in front as behind. I believe that this phenomenon is probably due to the resistance against the pressure of the strongly developed ocular muscles. Also in the human eyeball the sclerotic coat of its rear pole is the thicker, altho it is not so excessivcly thick as the whale. I should give in this case, too, the same explanation as for the whale.

I understand that the sclera of the eye of any animal is usually so constructed as to resist the pressure of the ocular muscles.

I once studied anatomically many Japanese eyeballs, and have found that the longest diameter of the adult eyeball runs from its inner-upper part to the outer-lower.[3] But I could not find the same condition in the eyes of the newborn and babies under one year, with few exceptions. I concluded, a posteriori, that the diameter, which runs from the inner-upper part to the outer-lower, is the longest of all the diameters of the eyeball. And I explained this condition as due to the relation of the insertions of the muscles on the eyeball and the pressure produced by their contraction.

I have conducted experiments in rabbits to determine the relation between the pressure of the ocular muscles and their influence upon the diameters of the eyeball. Ascher brought some young rabbits to the condition of forced convergence by advancing the attachments of their internal and inferior recti. After about five months he found no change of the form and the diameter of the eyeball. I have repeated the same experiment and found no influence upon the length of the diameters of the eyeballs.

Therefore I decided to make a stronger pressure upon the eyeball. For this purpose I used a foreign body, which I tried to wedge between the ocular muscles and eyeball. As a foreign body I have used an absorbent cotton-ball, which is tied fast by silk thread. It is almost as big as a kernel of rice and is disinfected by boiling. The operation, which is to put the cotton-ball between the muscles and eyeball, was only successful on the upper side, that is, between the superior rectus and the eyeball. On the other three sides I had no success, because the ocular muscles were easily broken during the manipulation. On these three sides I was obliged to leave the cotton-ball over the exposed muscles, putting the foreign body in between the margin of the orbit and the corresponding muscle. In this way the eyeball may be constantly compressed by such a foreign body. At the beginning of these experiments I used to expose the ocular muscles by cutting the bulbar conjunctiva. But this operation often results in inflammation of the corner, so I improved it at last by incising the eyelid without hurting the bulbar conjunctiva for the purpose of exposing the muscles.

In these experiments 41 young rabbits (22-30 days old) were used, and in one eye of each rabbit a foreign body was inserted, while the other eye served as the control. Six months after the operation nine rabbits were alive, in three of which the foreign body was inserted on the upper side, and on the other three sides in two rabbits each. In these nine cases the three on the upper side (No. I, II and III of the next table) and the one on the lower side (No. IV) showed the following results, while the others showed no change of the diameters of the eyeballs:

	Vertical Diameter (in Mm.)		Transverse Diameter (in Mm.)		Antero-posterior Diameter (in Mm.)	
No.	Normal Eye	Operated Eye	Normal Eye	Operated Eye	Normal Eye	Operated Eye
I	17.35	15.8	18.4	18.8	16.3	16.5
II	17.7	17.5	19.2	19.4	17.1	17.2
III	16.6	16.0	17.3	17.4	16.0	16.0
IV	17.6	17.4	18.9	18.9	16.8	16.8

In experiment No. I, I have found that the part of the eyeball-wall, where the foreign body was wedged in, was :

bit flattened therefore the vertical diameter of the operated eye was 1.55 mm. shorter than that of the normal side, and the transverse diameter of the former 0.4 mm. longer than that of the latter, and the antero-posterior diameter of the former is 0.2 mm. longer than that of the latter. But the other cases showed only slight differences between the operated and normal eye or remained unchanged.

I decided to let the antero-posterior diameter undergo the influence of a stronger compression. So I bound the equator of the eyeball of young rabbits by silk thread, instead of wedging in a foreign body. For this operation a greatly curved needle was stuck thro the eyelid near the anterior or posterior canthus without hurting the eyeball or the bulbar conjunctiva, and running around the equator of the eyeball the thread was brought out again at the puncture and there tied. For this experiment six rabbits (25 days old) were used, of which three were living after six months. I enucleated both eyes of these rabbits, and found the silk thread tied around the operated eye already broken. The results of the measurements are as follows:

	Vertical Diameter (in Mm.)		Transverse Diameter (in Mm.)		Antero-posterior Diameter (in Mm.)	
No.	Normal Eye	Operated Eye	Normal Eye	Operated Eye	Normal Eye	Operated Eye
I	17.15	17.0	18.6	19.0	16.8	17.4
II	17.1	17.0	18.35	18.5	16.7	16.9
III	17.2	17.2	18.6	18.7	16.7	17.0

According to these experiments we can understand, that strong compression caused the antero-posterior diameter to lengthen, and these cases showed myopia (No. I myopia of 10 D, No. II and III that of 7 D) before their enucleation. But they all had nubecula near the margin of cornea, therefore these degrees of myopia cannot exactly correspond to the length of the antero-posterior diameter, and there was found no developing of conus at the fundus.

As a result of the experiments with rabbits, mentioned above, we conclude that, even a pretty strong compression, continuous upon the eyeball, cannot greatly lenghten its diameter. Therefore it seems likely that the pressure of the ocular muscles alone upon the wall of the globe cannot greatly change the antero-posterior diameter, if the wall is normally strong. But, if the resistance of the sclera is weaker than normal, even the compression of the ocular muscles alone could lengthen the antero-posterior diameter. I would ascribe the developing of juvenile progressive myopia to the pressure of the ocular muscles upon eyeballs with weak sclerotic coats.

II. The sclera is to be regarded as a part of the cranium. Most vertebrates below the Mammals have a cartilaginous layer in the sclera, and many Selachii have a cartilaginous ocular support, which pushes into the orbit from the wall of the skull and supports the eyeball behind. Gegenbaur[4] rightly interpreted the existence of a cartilaginous ocular support as an indication that the sclerotic cartilage is derived from the skull. The form of the ocular support is not always the same; in some it is absent altogether, in others it is imperfectly developed, a rudimentary ocular support as suggested by Franz[5]. In any case the existence of the ocular support evidently proves the closest relation between primordial cranium s. chondrocranium and sclerotic cartilage.

I have pointed out that, at the beginning of the development of the sclerotic cartilage in the chick embryo, the cartilage first appears in the sclera at a point, which corresponds to the part where in the Selachii the ocular support touches the eyeballs. Therefore I regarded the sclerotic cartilage of the embryo as a part of the primordial cranium, and so consequently the sclera in the adult animal as developmentally a part of the cranium.

My opinion is not unreasonable from the embryologic point of view, for at the beginning of its development the eye starts as the primary optic vesicle at either side of the primary fore-brain. Therefore the sclera developing around the primary optic vesicle may corre-

spond to the cranium, which develops around the brain.

But the eye has its orbit. It may be thought that what corresponds to the cranium for the brain, is the orbit for the eye. But I have found such a correspondence unreasonable by my study of the orbit[6]. If we make a comparative study of the several bones in the so-called orbital wall of Amniota, we can assure ourselves these bones belong to the organs surounding the eye, or connect the surrounding organs with each other, and there is no bone, which must belong specially to the organ of vision. Therefore it is not correct from the standpoint of comparative anatomy to compare the relation of the orbit to the eyeball to that of the cranium to the brain. Altho the structure of the sclera is not always the same in the different kinds of animals, I can make the following suggestion.

The sclera of the eye corresponds to the cranium of the brain; consequently the sclera may be compared to the skeleton of the human body.

III. Development of myopia and its prophylaxis.

In the preceding paragraphs I have related some experiments concerning the relation between the compression of the ocular muscles and the resistance of the sclera against it, and from these I have concluded that the development of progressive myopia is due chiefly to more weakness of the sclera than normal. Therefore according to my thought the weak sclera causes a predisposition to myopia. Because of the correspondence of the sclera to the skeleton, some scrofulous, weak children may have a predisposition to progressive myopia.

Formerly tenotomy of the external rectus was tried as a treatment and prophylaxis of myopia. But there was no good effect.

I think that is because altho by the tenotomy the pressure by the ocular muscles on the eyeball may be temporarily a little reduced, unless the resistance of the sclera against the compression can be increased, such a treatment cannot assure a permanent cure for myopia.

Owing to my opinion as stated above I would at first suggest an improvement of the constitution as the prophylaxis for progressive myopia. Hence for children with weak constitutions an attempt must be made to strengthen the skeleton and with it the sclera. For this purpose I suggest, for scrofulous children especially, some proper sports.

According to my study[3], the size of the eyeball of children reaches by 8-9 years that of the adult. But of course the skeleton of children at that age is not so big and strong as that of an adult; and so the sclera in childhood may not be so strong as that of an adult. Usually progressive myopia develops in children of primary school age. Therefore in children, whether they have a predisposition to myopia or not, unhygienic exhaustion of the eye must be garded against, because unhygienic use of the eye can give an excessive compression of ocular muscles upon the wall of the globe, which is not yet strong enough to withstand it. This gives an opportunity to break the balance between the pressure of the muscles upon the eyeball and the resistance of the sclera against it. That is to say, this may provoke the development of myopia. I mean by "predisposition to myopia" in the above "ones with weak constitution, heredity of myopia and so forth."

By way of summary we may say that proper exercise for children with myopic predisposition forms the active prophylaxis for progressive myopia; and as a measure of general prophylaxis all children should be guarded against exhaustion of the eye.

REFERENCES.

1. Weber, M. Die Säuger. 1904, p. 564.
2. Pütter, A. Graefe-Saemisch Handbuch, v. 3. Organologie des Auges, 1912, p. 386.
3. Ochi, S. Nippon Gank. Zasshi, v. 21, No. 3; v. 22, No. 1.
4. Gegenbaur. Vergleichende Anatomie der Wirbelthiere, 1895.
5. Franz, V. Lehrbuch d. vergl. microsk. Anatomie. Sehorgan, 1913, p. 291.
6. Ochi, S. Vergleichende Anatomie der Amniotenorbita. Mitteilungen aus d. med. Fakultät d. Universität Kyushu, v. 4, 1917.

TUBERCLE OF THE CONJUNCTIVA.

JAMES ALLEN PATTERSON, M. D.

COLORADO SPRINGS, COLORADO.

This is the report of a case which was exhibited at the February, 1919, meeting of the Colorado Ophthalmological Society (see p. 343), with a note on subsequent progress.

I beg to show this case of Tubercle of the Conjunctiva, offer some remarks upon its diagnosis and treatment and exhibit photographs of the condition taken three weeks after the operation, which will be mentioned. A much milder case with tinted illustration was presented to this Society in 1916[1].

This boy, age 13, was first seen on Sept. 21, 1918, his parents giving a history of enlarged parotid gland for some weeks, which was suspected to be mumps when first observed.

The conjunctival trouble had been present all summer and had been treated by the family physician, who used argyrol. Inspection showed the upper lid of the right eye to be thickened and sufficiently heavy to give the appearance of ptosis. Further observation disclosed a large tumor mass high up under the lid which prevented the lid being everted unless great force was used. The bulbar conjunctiva was white excepting for two small reddish elevations near the caruncle, extending toward the limbus, which were accompanied by vessels springing from the caruncle. There was a third small one in the lower cul de sac below the others, otherwise the lower lid was free from invasion.

There was great enlargement of the upper part of the parotid gland, also of another gland which is located just below and over the malar process.

The nose was normal but the tonsils and adenoids were enlarged. The patient did not appear ill, the color of his skin was good, altho his appetite was poor, and his body weight below normal. He had been brought to this climate for the relief of asthma, which has subsided.

Owing to the condition of the tonsils, the enlarged glands, and the fact that the lid could not be everted without sufficient force to cause considerable pain, it was decided to remove the tonsils and adenoids; and while the patient was under the anesthetic, to turn the lid for exploration and treatment. This was done on Sept. 25, when there was found under this eyelid large masses of granulation-like tissue, a majority of the granules being surmounted by a small yellow spot, quite suggestive of tubercle. Slightly to the nasal side of the center of the everted lid there was a deep ulcer, fully 3 mm. in width, extending to the cartilage. The exposed surface was thoroly scrubbed with gauze. It was then found that there remained very tough ridges of a lineal ulcer extending horizontally over the entire everted lid; the ulcer first mentioned being as it were, the bottom of the crater. These hard edges were trimmed smooth with scissors, cauterized with nitrat of silver, it being the only available caustic at the hospital.

The tonsils and adenoids were then removed, a large mass of cheesy material being evacuated from the supratonsillar fossa of the left side.

The next day the patient returned home, it being notice that the glandular enlargements had already lessened in size and were softer. The eye showed almost no reaction.

Diagnosis. The tentative diagnosis of tubercle was made from the glandular involvements and the appearances.

As the photographs show there were on all sides of the ulcer the typical papules, surmounted by small tubercles. The appearances were not in any way suggestive of trachoma, and the ulcer still further disproved it. Furthermore there was not the horny nor flattened pavement-like appearances, nor were there any symptoms that would suggest any likelihood of the affection being vernal conjunctivitis. Parinaud's con-

junctivitis was thought of, and the microscopic illustrations of Verhoeff's observations (A. J. O. Oct. 1918) were compared, but the pathologist excluded the possibility of such diagnosis. (Figs. 1 and 2.)

Smears taken showed the presence of tubercle bacilli. The excised specimens were given to Dr. Ryder, of the laboratory of Drs. Webb and Gilbert, who reported that the sections showed areas of caseation with tubercle bacilli in the surrounding margins. These bacilli as well as those found in the smears were acid fast. Dr. Ryder found no cartilage in the sections.

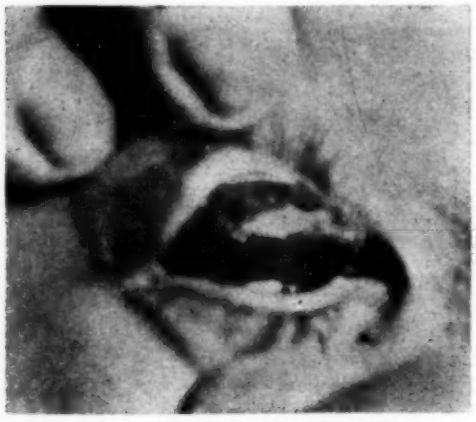


Fig. 1. Fig. 2
Tuberculosis of the Conjunctiva (Patterson).

Treatment—I have noted on Oct. 17, that the eye has been treated twice weekly, that there has been some improvement, particularly of the small elevations on the palpebral conjunctiva. Up to Nov. 9 the improvement was very slow, and after trying glycerit of tannin, saturated solution of trichloracetic acid and formaldehyd in varying dilutions up to full strength, I began giving 1/10,000 mg. of O. T. once a week, which dose was not increased until three weeks ago; it has now reached 1/5,000 mg.

After the first two injections there was a very small local reaction, which disappeared inside of twenty-four hours.

The tuberculin has had more action upon the glands than upon the invasion of the lid. After every dose of the T. O. there has been some lessening in size of the glandular swelling and coincidently he has had at times threatenings of asthma, just a slight, barely noticeable wheeze. The lid has, however, seemingly been improved more by the trichloracetic acid used to cauterize thoroly than by any of the other methods tried. This has been done once weekly.

The invasion near the caruncle mentioned, disappeared within three weeks but there has been some characteristic extension upon the lower lid involving the outer half. This extension has been modified and its spread controlled by the same treatment.

April 23, 1919. The patient has not had tuberculin since Feb. 15. He was taken from school for three weeks, kept out-of-doors, and not allowed to become fatigued. This regimen with a local treatment once a week, has produced marked improvement. The invasion mentioned upon the lower lid has disappeared; the upper lid, although pale from scar tissue, is smooth. The eye is white, free from iritation and conjunctival discharge.

REFERENCE

1. Patterson, J. A. Tubercle of the Conjunctiva. Annals of Ophthalmology, v. 26, p. 76.

NOTES, CASES AND INSTRUMENTS

SUBCONJUNCTIVAL GRAFT OF FASCIA LATA.

JOEL WHITAKER., M. D.

INDIANAPOLIS, IND.

I wish to report a subconjunctival graft, which I used recently with success.

The boy was injured by a splinter of kindling wood piercing his right eye. The wound was at "9 o'clock" on the corneoscleral margin, and just in front of the ciliary body, and extended over three millimeters into the cornea. The iris was torn by the splinter, but fortunately the lens and the ciliary body were uninjured.

The wound occurred in the summer of 1918, and the eye was first treated at a dispensary in Louisville. I saw the boy about July at the Indianapolis City Dispensary; there was then a protrusion of the iris thru the unhealed wound. I did an iridectomy and covered the opening with a single conjunctival patch, after Kuhnt's method. This conjunctival patch was not strong enough to hold, and "ballooned" over the opening with a little more iris protruding.

I again did an iridectomy and used a double conjunctival patch with the same unfortunate result.

On December 10, 1918, there was no plus tension with a McLean tonometer, and the vision was 20/100, so I knew a stronger patch was necessary. While talking to Dr. Murray Hadley, a surgeon of Indianapolis, he suggested fascia lata, and it was this which I used.

I cut away the conjunctiva over the wound and undermined it well back. At the corneal edge of the wound I split the cornea which was much easier to do on account of the conjunctiva which had become attached from the former patch. The opening into the eye was then entirely exposed, irregular in shape, and about 4x3 mm. in size. I took a piece of fascia lata about 1 cm. square, trimmed off the edge to dovetail into the split cornea. I placed this patch under the conjunctiva and put the beveled edge into position where I anchored it snugly with a single stitch, passing thru the fascia lata and outer portion of the cornea. I then passed a silk suture thru each of the other edges of the fascia letting them come out thru the conjunctiva well back. By tightening these three stitches I could use them as "guy ropes" against the point anchored to the cornea, to make the patch fit more snugly to the eye, and at the same time loosen up the conjunctiva with which to cover it. These stitches were then tied and the patch entirely covered with the conjunctiva.

I have seen the boy several times since, and the eye needed no further interference beyond removing the stitches.

In July, 1919, the patch had every appearance of doing all I could wish. His vision was then 20/70. Tension was 22 mm. with McLean tonometer, and with his correction of $+1.00$ S $\bigcirc$ $+2.50$ C ax 70° he had 20/20 vision under mydriatic.

I believe from my single experience that fascia lata has proven to make a live subconjunctival graft of great strength, which is tolerated by the cornea. It can easily be gotten under local anesthesia from the leg just above the knee, thinned down and cut into any desired shape. All of the thinning down should be on one side, leaving the other smooth surface to go next to the sclera and the opening. While I have never used it for the purpose, I believe fascia lata could be better used than any other substance for replacing tarsal plate, should this be desired.

HEREDITARY CATARACT IN CALVES

CHARLES P. SMALL, M. D.

CHICAGO, ILLINOIS.

The occurrence of hereditary cataract in calves was recently demonstrated upon five blind animals in the experi-

mental department of the College of Agriculture, University of Illinois. The youngest animal examined was a heifer, four months old; the oldest a heifer, one year and eleven months old. Two bulls, about six months old, and a heifer, seven months old, completed the number.

With the exception of the youngest animal, both eyes of all the others presented mature cataracts. Small chalky dots of further degeneration in the lens substance were seen in most of the cases. Because of the oval shape of the pupil, it was possible to view the fundus thru the clear opening between the edge of the opaque lens and the nasal border of the iris. In several of the eyes the lenses, apparently undeveloped in size, were seen thruout their entire circumferances, giving the appearance of a glass marble suspended in the clear vitreous. The other ocular conditions were practically identical in all the animals. Intraocular tension, so far as could be judged, was normal. There was no ciliary nor conjunctival congestion. Light perception and a good degree of light projection was found in all cases. The pupils responded readily to light.

Both atropin and homatropin were employed, similarly to its use in the human eye, to observe the mydriatic effect. Full mydriasis was obtained in about one hour. In most of the eyes, dilatation of the pupil was uniform; in a few eyes there were slight points of posterior synechiae. The fundi were examined by an electric ophthalmoscope. The normal tapetum was seen, but very faintly or not at all. In other respects they appeared normal.

In the case of the four months old animal, the cataract was apparently soft; there was a loss of transparency, and the opaque radiating striae were faintly in evidence.

Thru the courtesy of Professor J. A. Detlefsen, of the Laboratory of Genetics, and his associate Mr. W. W. Yapp, who have in preparation a paper on the genetic aspects of this condition. It may be stated that their observations thus far carried out, correspond very closely to the Mendelian theory. Eleven blind calves have been observed, where they might have expected to find 9.375.

Of the five animals reported here, four came from a mating of the son of "Old Homestead" to his own half sisters, which were daughters of "Old Homestead." That is "Old Homestead" was mated to a number of unrelated females. The daughters from this mating were mated to a son from this mating. The youngest animal was derived from a daughter of "Old Homestead," mated back to "Old Homestead," her sire.

TRAUMATIC CATARACT. LENS ABSORBED WITHOUT OPERATION.

JAMES H. MCKELLAR, M. D.

LOS ANGELES, CALIFORNIA.

Believing that in some cases of traumatic cataract, operation is advised too readily, I present the following three cases, showing what nature will at times do, unassisted by operative interference. This is in no way a criticism of operation when absorbtion does not take place otherwise within a reasonable time; or when complications clearly indicate it. In such a case as II, I believe operation should always be advised. These cases are of interest also, in that they differ essentially in character from one another.

The first case is one of subconjunctival dislocation of the lens. The second of traumatic cataract, due to contusion; the third of traumatic cataract, due to punctured wound.

In each of these cases, practically the only treatment used was rest and instillation of atropin solution, with iced compresses at intervals at first, (if we except Christian Science treatment in the second case); yet in each case the ultimate result was as good as it could possibly have been, had the operation been resorted to.

CASE I. Negro bootblack, age 45, came to my office in April, 1909.

History—The night before he had engaged in a fist fight, and was struck on the right eye. Had not been able to see plainly with that eye since.

Examination — Lids swollen. Globe rather soft. Mass under conjunctiva temporal to limbus, which apparently consists of iris and cataractous lens. Conjunctiva unbroken. Break in the continuity of iris, corresponding to the portion seen under the conjunctiva. Eye aphakic, media fairly clear, fundus normal.

Diagnosis—Traumatic dislocation of lens and iris subconjunctivally. Iridodialysis. Rupture of globe.

Treatment—Rest and atropin.

Result—Eye was soon quiet, and tension normal. Dislocated lens became entirely absorbed. Dislocated iris shrunk. I was able to follow this case for a number of years. He had no complications of any kind during that time, and vision was good with correcting lens.

CASE II. Sept., 1913. Boy aged 10.

History—Stated that he had been struck on the left eye, the day before, by a schoolmate. Had not been able to see with that eye since.

Examination — Conjunctiva injected. No wound of cornea or conjunctiva. Lens cataractous and swollen. Tension normal.

Diagnosis—Traumatic cataract.

Treatment—Rest and atropin. Iced compresses at intervals.

This case progressed favorably for several days, then I saw him one day, with marked pericorneal injection, and exceedingly high tension. I advised operation, which advice was refused. The case passed from my observation for several months, then one day the mother brought the boy to see me (partly, no doubt, that I might be enlightened as to the beneficent effects of Christian Science treatment, which she stated the boy had been receiving).

The eye was entirely free from irritation. The pupil was clear, the tension normal, and the vision was approximately normal with correcting lens.

*CASE III. Jan., 1918. Boy, age 6.

History—Mother stated that several days before he had been playing with a hat pin, which had struck him in the right eye, since which time he had not been able to see with that eye.

Examination — Pericorneal injection. Punctured wound of cornea. Lens swollen and cataractous; tension normal. Iris uninjured.

Treatment—Rest and atropin. Iced compresses at intervals for first few days.

Result—Lens became absorbed uneventfully, and by October, 1918, pupil had entirely cleared. The eye was quiet, and with correcting lens vision was approximately normal.

---

*This case has been reported in the California State Journal of Medicine.

SOCIETY PROCEEDINGS

AMERICAN OPHTHALMOLOGICAL SOCIETY.

FIFTY-FIFTH ANNUAL MEETING.

Atlantic City, June 14-17, 1919.
President, DR. LUCIEN HOWE
of Buffalo.

Requirements of Ocular Examinations for the Army.

DR. WILLIAM H. WILDER, Chicago, considered these in detail. The changes made in such requirements since the beginning of the recent war have been chiefly in the direction of discriminating more closely between those conditions that actually incapacitate for service and those that do not. The general tendency has been to admit for special service those with defects that would incapacitate for some other branches, but do not interfere with the particular work of that special branch.

As to malingering, he found it impossible to ascertain the visual acuity of malingerers who consistently adhered to the claim that they could not see the largest test letters. But it was difficult to prove that they were making a false claim, or that they had vision sufficient to meet the requirements, altho they might be proved to have enough to avoid objects likely to hurt them.

DISCUSSION.—Dr. E. C. Ellett, Memphis: All who had to do with the work in the camps must have marveled at the sort of men that occasionally got in. I saw one man brought in on a stretcher, with a shortening of one femur, so that he could not walk a step. One was mentally deficient, so that the family never allowed him to go about without an attendant. I think that the way in which these things happened was that the men were summoned to appear before a draft board, and if they did not do so, they were summarily put into the service. I saw another who had been made a noncommissioned officer and recommended to be sent to a training camp for officers, and was found to have an artificial eye. The camp I was in had a board that worked most efficiently. All the men who came to camp went before that board, and every man whose hearing or vision was not normal was immediately referred to the proper specialist for more complete examination.

Dr. Allen Greenwood, Boston: I just want to discuss one point, reclassification, which was the problem that came before the ophthalmologists in France. It was the subject of a great deal of thought on the part of Drs. Black and Derby and myself. Reclassification was asked for because the former classification was not clearly worded.

Dr. Wilder, closing: There was one point that I wished to bring out, in connection with the tests of malingerers that I found very useful. It is the ordinary prism test; using the fourteen or sixteen-degree prisms and putting the apex above and the base below. This makes two charts on the wall. You ask the man to read the first one, and then the other. You demonstrate that he can see two with the ordinary prism test. Then, when you raise it, you demonstrate, when he reads from the lower chart, that he is reading with the alleged blind eye.

The test for visual acuity, I think, is not very valuable for the class of people who insist that they cannot see well with either eye, and who habitually do not read the top letter of the chart. We scattered nails on the floor and had them walk around without their shoes, and they studiously avoided injuring their feet. We thus found cases of malingering that we could not find in any other way.

Dr. Alexander Duane, New York: I have succeeded in detecting two cases of malingering by another application of the prisms: one that would produce, if the patient were really using two eyes, a confusion; but that if he were really excluding one eye, would not cause confusion. I have succeeded in that way in convincing the friends of the person, in accident cases, that he

was either selfmisled or misleading them.

The Eyes of the Signalman.

Dr. Alexander Duane, New York, read the paper published in full in this JOURNAL, p. 555.

Observations of an Administrative Officer.

DR. WALTER R. PARKER, Detroit, gave an outline of the history of the recognition of specialties in the army medical service; and the organization and work of the Division of Surgery of the Head. Important functions were the selection of officers fitted for the special duties involved, the training of such officers in their specialties, the selection of special equipment required to make their work effective, and the organization of agencies and methods for assisting in the restoration and re-education of the soldiers requiring special treatment.

It had been extremely difficult to get specialists properly placed near the front so as to make their special ability available. Altho the specialties of brain surgery and dental surgery were likely to be dropped, those of ophthalmology and otolaryngology would be continued in the permanent organization of the army medical service after the war.

DISCUSSION.—Dr. Allen Greenwood, Boston: The work that was done abroad was predicated on the work that was done in the Surgeon General's office; and no man in America has done so much for the specialties in the army as Colonel Parker. It is due to his efforts, his workings with the general surgeons and convincing them of the necessity for the specialists, that we have gained what we have today for ophthalmology and the other specialties.

Dr. George E. de Schweinitz, Philadelphia: Colonel Parker has directed me to make an addendum to his paper. It is perfectly true that cantonment instruction in the head specialties, particularly ophthalmology, was not a brilliant success; but there were two exceptions. They had a very excellent school under the control of Colonel Todd, altho whether particularly in ophthalmology or not, I cannot state. Another successful school was at Camp Lewis, where a great deal of trouble was taken to instruct not only the ophthalmologists, but also those interested in the problems of ophthalmology as a specialty, and in its broader relations to general medicine.

Ocular Manifestations Following Exposure to Poison Gas.

DR. GEORGE S. DERBY, Boston, Mass., read a paper pointing out that the Germans first began to use gas for the purpose of disabling their enemies. It was at first sent over in the form of drifts or clouds. Among the varieties thus sent over was the so-called *lacrimatory gas*, which caused burning pain, copious lacrimation, injection of the conjunctiva and photophobia. There was also fine exfoliation of the epithelial covering of the cornea. The milder cases recovered very quickly, the corneal lesions showing no tendency to extend. The more severe cases were usually well within two weeks.

Much more serious were the injuries inflicted by *mustard gas*, which was first used in July, 1917. It was sent over in shells, and caused sneezing; painful irritation of the nose, throat and eyes; and sometimes vomiting. Its action was not noticed until from two to six hours after exposure, when severe erythema of the skin developed, followed by blistering, the moist parts of the body being more severely affected. Respiratory symptoms also developed; and in severe cases, bronchitis and secondary pneumonia. There was profuse lacrimation and considerable injection of the conjunctiva.

The mild cases constituted seventy-five to eighty per cent of those affected. In the remainder, the more severe cases, the lids showed redness and swelling, and often the formation of bullae. They were tightly pressed together, and all attempts to open them caused severe pain. In these cases, the cornea is markedly injected, and may show chemosis. In severely burned

cases, there is often an area of solid white edema of the conjunctiva in the palpebral fissure. The corneal lesions are also of varying severity, principally consisting of a roughening of the epithelium with irregular grayish scattered areas of opacity. In very severe cases, there is a whitish band traversing the cornea in the area of the palpebral fissure.

Eyes that are bandaged are made worse. It may cause secondary infection of the cornea. The lesions produced by mustard gas are in the nature of a chemical burn. In mild cases, recovery may take place in from one to two weeks. The moderately severe cases may last from four weeks to two months; and it may be four months before the most severe cases can return to duty. The nervous effect produced by the severe irritation of the eye sometimes produces a neurotic condition that is hard to overcome. The man fears that he is going to become blind, and often the general condition is impaired.

The gas mask will protect the eyes from the effects of mustard gas; but if they have been exposed to it, they should be washed out frequently with sodium carbonat or boric acid solution. A drop of some oil, such as liquid albolene, should be instilled. When there is much blepharospasm and irritation, atropin should be used. The eye should not be bandaged, but a shade or a pair of dark glasses should be worn. In cases of secondary infection, protargol or argyrol should be employed. Cold bathing and the instillation of a weak solution of sulphat of zinc are also of value. The patients always recover with normal vision, unless a severe involvement of the cornea has taken place.

Discussion.—Dr. F. H. Verhoeff, Boston, Mass.: At Camp Devens I saw a number of these gas cases when they returned to this country. Their eyes were still in a very much irritated condition. Sometimes they quieted down somewhat; but the slightest irritation gave them a great deal of photophobia and made them unable to use their eyes. Exposure to cold might start them up. I saw all grades of sensitiveness. In a few cases, there was permanent corneal involvement, with vision cut down to 20/100, and there seemed no prospect that vision would get better.

I found nothing that would relieve this irritation. Weak cocain solution would make them worse, if kept up for any length of time. Castor oil seemed to produce a little benefit in some cases, but I finally decided to use nothing; and they did better on that than on anything else. The question arose in my mind whether these eyes that had been badly exposed, even without corneal involvement would ever reach a normal condition. It seemed to me that the men would have more or less trouble all their lives.

Dr. Walter B. Lancaster, Boston, Mass.: Dr. Derby spoke of the importance of starting these men right, by not letting them think that their trouble would be serious. There are two lessons to be drawn from these cases. One, the importance of starting the patients right, so that they will not fear the loss of their sight, or permanent disability; and the other is that similar things occur in private practice. Very slight injuries happen, and all the troubles of the patients are attributed to these injuries; while the truth is that the injury was only an insignificant factor, and simply started the ball rolling, the trouble being kept up by the patient's attitude towards it.

Dr. Allen Greenwood, Boston, Mass.: Several points that Dr. Derby has brought out I wish to emphasize. One is the early treatment of these cases. We made efforts to have them treated within five or six miles of the front line, and the gas service was under the charge of a special medical officer. He wrote out for us some circulars, to be sent to the regimental surgeons and medical officers at the front, calling attention to the points that Dr. Derby has mentioned, particularly the nonuse of bandages. I saw one case that had come from the front in which both corneas were destroyed; and the patient

said that a bandage had been on both eyes and left there for three days, during transportation. Colonel Derby has told you that he went to one hospital and removed many bandages at one time. That bandaging was done away with later. In the circular, we advised avoidance of bandaging, early treatment and care not to hospitalize these cases. They were prone to become hospitalized. I saw one man who had been in the hospital for three months, in a dark room, and was in very bad shape. The only treatment that I advised was to send him out doors the next morning, without colored glasses or eye-shade, to work in the garden. That treatment produced a cure within twenty-four hours, showing the psychic influence on the condition. In the severe cases, it is similar to any caustic burn. Those who have seen mild burns, with the whitened conjunctiva lifted up around the cornea, and the usual corneal involvement that follows such severe burns of the conjunctiva, will have a good picture of these cases.

It is well to call attention to the really severe results following the use of gas in the war. One experience will always remain with me. In a little hospital six miles back of the firing line at Baccarat early in the spring of last year, there were brought in, during one afternoon, one hundred and fifty men who had been badly gassed. They took out thirty-five dead bodies from the ambulances that had contained one hundred and fifty living men when they left the front. All had been badly gassed by phosgene and mustard gas combined.

Dr. Edward Jackson, Denver: I saw a patient accidently exposed in the manufacture of gas in this country about seventy-two hours after exposure. The trouble with the eyes had appeared about thirty-six hours after the probable time of exposure. There was a free discharge from the conjunctiva, which consisted almost wholly of young epithelial cells. There were no polymorphonuclears, and no bacteria whatever were found.

Dr. Nelson M. Black, Milwaukee: Dr. Derby and Dr. Lancaster have called attention to the fact that it is important to start the men right, with the idea that they are not going to lose their eyesight. Dr. Derby hit upon an admirable plan. The men felt that they must have some protection from the light. As eye-shades were practically unobtainable, and dark glasses few and far between, Dr. Derby suggested to the nurses and men in the service to utilize the blue paper that came around absorbent cotton, and make eye-shades out of that. The result was that many men, who wanted to keep their heads down and their hands over their eyes, could go out and face the light that they had been so afraid of, by making small shades out of blue paper and putting it under their overseas caps. In a very short time, being guyed by men of their acquaintance for wearing this shade, it would come off, and they would be on the high-road to recovery.

Dr. Derby, Boston: There are three brief points that I wish to discuss. First, in regard to what Dr. Verhoeff said, that the experiments made under the direction of the medical war service showed that it is not improbable that hypersensitivity to mustard gas may occur in cases showing a persistent thymus and characteristic lymphoid hyperplasia. Second, eye-shades or dark glasses must be worn so long as the action of the atropin still exists. You cannot tell a man to take off the shade until that has disappeared. The third thing that I want to refer to is that Warthin and his associates have an excellent exhibition of slides of microscopic and other photographs at the Steel Pier, with the other exhibits; and it certainly is well worth seeing.

Primary Treatment of War Injuries to Orbits.

Dr. Allen Greenwood, Boston, read a paper in which he called attention to the importance of preserving all tissue possible, in opposition to what was generally done in the case of wounds elsewhere. Primary suture of lid wounds, provided there is not a tremenous loss of tissue, is always indicated at the earliest possible moment

and with the greatest accuracy. Any debridement of lid wounds, such as is performed in other parts of the body, is absolutely contraindicated.

Small foreign bodies in the orbit should be left alone unless they are causing some trouble. Larger and more devastating foreign bodies in the orbit can be removed if this is possible without destruction of living muscle and nerve tissue.

Discussion—Dr. George S. Derby, Boston: I should like to emphasize one point that Colonel Greenwood has emphasized; and that is, leave foreign bodies in the orbit alone, unless you have to go after them, or unless they are large. A great many were left in, in France, and have been there ever since; and the men are apparently perfectly well. The orbit is a bottomless pit, it is often hard to find even a fair-sized body, and a great deal of damage may be done in searching for it.

Dr. George E. de Schweinitz, Philadelphia: Colonel Lister speaks of the comparative infrequency of hole in the macula as compared with other concussion lesions. That is not the experience in the concussion lesions that have come back to this country. At No. 11 and other camps, we have had a proportionately large number. Of the twenty-six severe concussion injuries that I examined, I found five typical holes in the macula—a pretty large proportion; and a great many have been reported since.

Dr. Derby: I was rather surprised at Colonel Lister's statement; because, working in No. 83 Hospital, I saw more holes in the macula than I had ever seen in my life before.

Dr. Edward Jackson, Denver: In relation to the frequency of holes in the macula, the examination of recruits for our army, including a careful ophthalmoscopic examination, showed that holes in the macula were much more frequent than the literature previously published would have led us to believe. I have a considerable series of cases that were found in that way. The most of these patients could give but little history of the cause of the hole. In many cases, the injury had probably occurred in early childhood; and the patients had never consulted an ophthalmologist or had their eyes examined with the ophthalmoscope.

Dr. Nelson M. Black, Milwaukee: Dr. Greenwood mentioned the fact that many of the men come across with such bad conditions of the orbit. In the early portion of the work in our army over there, when the evacuation hospitals were first organized, the ophthalmic section was not allowed to attach ophthalmic surgeons to them. Later, permission was given to do this; and, in ignorance of the conditions existing, the ophthalmic section did not select the most highly qualified ophthalmic surgeons for this work. This was an error; as the primary surgery is what counts in the end. As the result, in a large number of cases, an attempt was made at removal of the eyes, by the means that Dr. Greenwood speaks of, by the general surgeon.

Another factor was that in these evacuation hospitals, when the eye men were assigned to them, the percentage of eye wounds being relatively small, the eye man was not given a position on the general surgical team. He was given various other comparatively unimportant duties to do. Then, when a case came in, a chief on the surgical team would ask for the eye man; and considerable time was spent in finding him. When he was found, he had to get his instruments ready; and that took time. As the result, the surgical chief decided against sending for him, and enucleated the eyes himself.

Later, the suggestion was made by Colonel Greenwood that the eye surgeon be made assistant on a general surgical team to a general surgeon, and that tirage officers be requested to send all eye cases to this particular team. The general surgeon, in these cases, acted as assistant to the eye man. This change was made only lately, and did not become generally effective; but a great many officers acted on Colonel Greenwood's suggestion and did that. In the Third Army it was ordered that the eye man should be a member of a surgical team and assistant to the general surgeon, so as to be on hand at a"

times. When he was not on duty, the cases that came with eye injuries were sent to the ward. Then when the team to which the eye man was attached came on duty, the men's eyes were attended to.

Dr. Greenwood: I want to say that the suggestion of putting an eye man on the surgical team was made by Dr. Black, and not by me. I was glad to adopt his suggestion, which seemed exceedingly wise; and it worked out well, particularly when Dr. Black or Dr. Derby was a member of the team. The lack of ophthalmologists in the evacuation hospitals was a grave one in the early days. All had to go to the front and take positions in evacuation hospitals, and go from one to another during the stress of work, and try to cover these cases.

I want to draw one little picture of an evacuation hospital in time of stress. During the height of the Argonne offensive, I went to the most forward of the tip of the forest. It had been opened only two days. It had been raining a week, and was still raining, when I arrived there. The roads were a sea of mud. The hospital was in an old chateau, with tents scattered in the grounds around it; and practically every ambulance went up to the hub in this mud. The nurses and officers were wearing rubber boots; and those that were there to help out or to see how things were going wore overshoes. I entered the hospital at three o'clock in the afternoon. Every ward was crowded. Ambulances were coming at the rate of one every two or three minutes. Colonel Tracey, who had charge of the shock work, had four wards filled with shock cases. Among these cases were ten or fifteen men whose faces were practically ruined. I assisted the ophthalmic surgeon the best I could to patch them up temporarily.

I wish I had the power of speech and the ability to draw word pictures, so as to draw for you a picture of that hospital—the rain coming down in torrents, the sea of mud, the shock ward filled, a little heater at the foot of each bed, the men looking as if at their last gasp, ambulances coming in every two or three minutes, and the drivers exhausted. Thirty miles away, we had a special hospital for head cases; but it seemed a crime to ask the drivers to go thirty miles farther, to take these cases to the eye hospital. This shows the necessity of having a competent ophthalmic surgeon right at the spot.

Penetrating and Perforating Wound of the Eyeball with Diagnosis and Treatment of Retained Foreign Bodies.

Dr. William T. Shoemaker read a paper on this subject, published in full in the Journal, page 590.

Discussion.—Dr. F. H. Verhoeff, Boston: There has long been a general misconception as to the danger of sympathetic ophthalmia following retained foreign body, and I agree with the speaker that this is much exaggerated. During the past nine years, I have examined a large number of eyes having the typical picture of sympathetic ophthalmia; and in not one have I found a foreign body. On the other hand, I have examined a great number of eyes in which foreign bodies had been retained for a number of years; and none of these cases showed sympathetic ophthalmia. There is more danger of the latter I think, in removing the body than in leaving it in; because you produce so much more trauma.

Regarding removal of the body, I would say that I prefer the anterior route, whenever it is possible to use it. We produce so little damage to the anterior parts of the eye in removing it that this need not concern us. Another thing I have noticed is that when we attempt to remove the foreign body through the anterior chamber, it sometimes becomes lodged behind the iris. It comes out until it strikes the sphincter, which is a very rigid ring; and then the foreign body catches on the sphincter. The natural tendency is to put the magnet opposite and try to draw it out; but it would be better to have the traction tangential to the pupil. In that way, the foreign body will ride over the sphincter and come out in the anterior chamber. If it is caught very firmly, I should pull it back a little bit, and then it would come out easily. I have seen eyes greatly mutilated by attempts to get foreign bodies out that were caught in the iris.

Dr. Samuel Theobald, Baltimore: Regarding the retention of foreign bodies in the eye, if they are aseptic and incapable of undergoing serious change, they may not damage the eyeball or produce serious consequences. I have seen a patient who, about forty years ago, got a spicule of glass in his eyeball. It had lodged in the anterior chamber under the upper margin of the pupil. While the patient was in my office, it fell down behind the iris. There was a sharp inflammatory reaction; and undoubtedly, as that subsided, the bit of glass was encysted. From then until the present time, the patient has not been able to notice any difference between the two eyes.

Dr. George S. Derby, Boston: Whether I agree or not with the Moorefields School of London, as to the advisability of extracting foreign bodies anteriorly except the very large ones, I must certainly admire tremendously their very splendid techniq for extracting foreign bodies thru the anterior chamber, as I saw it in the No. 83 General Hospital at Boulogne. The foreign body was pulled into the anterior chamber; and an incision made thru the clear cornea with a selected keratome, very carefully, so that little aqueous was lost. The foreign body was then pulled forward by means of a magnet, after which the small magnet manufactured by Weiss, in London, which works on some dry cells was placed over the foreign body, which was thus drawn up to the wound and emerged from it, without the necessity of introducing the instrument into the anterior chamber.

Dr. C. F. Clark, Columbus, Ohio: I have been taught that a foreign body in the eye, in the course of forty, fifty or sixty years, will affect the other eye. Is it not too soon to draw any conclusions regarding sympathetic ophthalmia from war experiences? Has sufficient time elapsed?

Dr. Nelson M. Black, Milwaukee. In regard to the question of the occurrence of sympathetic ophthalmia from retained foreign bodies, I can say that we saw comparatively few cases of this in proportion to the large number of eye injuries. Comparatively few of these injuries were due to retained foreign bodies that were nonmagnetic, and cutting injuries, were due to other causes than those that would leave foreign bodies in the eye. I was wondering whether a possible factor in not having more sympathetic ophthalmia could not be the injections that the men received—typhoid, paratyphoid and tetanic injections—at the time of injury. Is that a factor worth considering?

Dr. William Tarun, Baltimore: I should like to speak of a few phases of this subject. One is the advisability of enucleating an eye during ophthalmitis. Dr. Chisholm, who had a hospital at Baltimore, has removed three thousand eyes for various lesions. A good many were having ophthalmitis, and he has not seen a single case of meningitis develop after removal of an eye for that cause.

Another phase is the development of the lesion in the eye itself. Dr. Randolph asked me to see a young man, an employe of the Baltimore and Ohio Railroad, who had had an injury some years before. Dr. Randolph, at that time, had removed a piece of steel from the eye, and the preservation of the eyeball was perfect. The macular region was destroyed, and he had only excentric fixation with the eye. Two months ago, he returned with a history of being struck on the opposite eye. Dr. Randolph found a small foreign body in the left eye. The right was the one affected. I was asked to see the man, and to do whatever was necessary. The X-ray showed a small foreign body in the vitreous, more or less movable as the eyeball was moved, and some short distance posterior to the lens. A number of hemorrhages were seen in the vitreous; and a number on the retina below. Vision was then 20/60; and the question was whether to leave the eye alone or remove the foreign body.

In view of the fact that he had had an injury to the opposite side, and that removal of this body would mean further destruction to the eye, I suggested that the eyeball be left alone, and that the patient be put on atropin, ice-compresses, rest, glasses and constitutional treatment with salicylat of soda and purgatives twice a week. I also suggested that he have his sinuses X-rayed,

the teeth looked after and the tonsils examined. He had all this done, and there did not seem to be anything wrong. His vision grew better, and came to 20/15. The foreign body was still present. The irritation had subsided, and everything was perfectly quiescent. It is quite a responsibility to determine exactly what shall be done with this man. He has a bad eye on one side, and operative interference on the other side is needed. We are just keeping him under observation. I am a believer in Elschnig's work. He has thrown much light on sympathetic ophthalmia. I do not think that it goes to one eye from the other, but believe that it is due to a constitutional cause. If those causes such as pus conditions about the body are eliminated, and the injury is of such character that the pigment substance had been destroyed from the entrance of the foreign body, I think that it is safe to allow the foreign body to remain, without the prospect of causing serious damage to the individual in after life. The foreign body in this case was a piece of steel.

Dr. Allen Greenwood, Boston: I want to suggest that probably we shall never come to an agreement as to the posterior and anterior routes. The decision depends upon the conditions present and upon where the work is being done. If we are considering Dr. Shoemaker's paper, we must remember that his work was connected with the military service in the very front line hospitals. In such circumstances the anterior route for tiny foreign bodies probably offers the better operation; because it is difficult to get X-ray localization. If you have a small body in the eye at a place where the X-ray can be used, my preference is to draw it through a small opening in the vitreous, nearest the point where the foreign body lies. You must judge which route is the best according to circumstances. The size of the foreign body and the personal equation must be taken into consideration.

As far as sympathetic ophthalmia is concerned, the war is so recently finished that one cannot give an opinion. I saw only one case during my entire service as consultant in the various hospitals. In that case, there was a foreign body in the eye, with a history of iridocyclitis of three weeks' duration. The eye was removed, and the sympathetic condition, uveitis, on the opposite side disappeared. I think that cases of sympathetic ophthalmia are going to be much less frequent than one would expect, considering the multitudes of ocular injuries. The condition has lost a little of its dread to the man who sees service. The condition of the opposite eye depends on whether there is an iridocyclitis that persists, in addition to an inclusion of the foreign body.

Dr. T. B. Holloway, Philadelphia: I wish to call attention to a complication in these cases that, while extraocular, may have wide-reaching effects. The surgeon at the Naval Hospital in Philadelphia referred to me the case of a man who had injured his eye. I found that a foreign body had plowed its way directly through the lens and had lodged in the vitreous. I had no difficulty in drawing this large foreign body into the anterior chamber; but while it was approximated against the posterior wall of the cornea, I had difficulty in getting it through the corneal incision. I asked the Resident to hand me an applicator, with which I depressed the lips of the wound. Another Resident picked up the porcelain-lined instrument tray and brought it close enough to the heel of the magnet to draw the tray out of his hands. After the atmosphere cleared, I found that this hunk of steel had been extracted very nicely and was attached to the end of the tip of my magnet. I mention this because a nurse or someone else may inadvertently pick up one of these trays and bring too close to the magnet, and the result may prove disastrous to the eye.

Concerning the Ocular Phenomena in the Psychoneuroses of Warfare.

Dr. George E. de Schweinitz, Philadelphia, read a paper upon this subject. It dealt with cases that are usually spoken of as due to shell-shock, altho, as he pointed out, the use of this term was so confusing and misleading, that it had been forbidden in army reports. The vast majority of these cases have all the characteristics of "peace time neuroses with a war-time coloring," and that "the neurosis is a maladjustment of the indi-

vidual to his environment," with the understanding that the results of a true neurosis, be it one of war-time or one of peace-time, are not conscious or voluntary. Many of these men had been confronted by what was for them an intolerable situation, from which the conditions that presented necessarily arose. These individuals were generally neurotic and biologically inferior, and symptoms arose unconsciously and by suggestion.

In general terms the cases include shell concussions, that is, those patients who have obvious physical lesions, or at least symptoms which may be assumed to interpret physical lesions — a small group not discussed in the paper except in incidental mention; and the large group of shell hysterias, psychoneuroses, and war shock. From the ocular standpoint, altho it is admitted that it is difficult to make sharp distinctions, for convenience sake the following classification is adopted. (1) Various types of amblyopias and amauroses, including disturbances of color vision—types which have in civilian practice been included under the terms incomplete and complete anesthesia of the visual sense; (2) asthenopias and anomalies of accommodation; (3) anomalies of the iris movements (pupil phenomena); (4) anomalies of the eyelids and eye muscle movements; (5) cases not classified in the above groups.

The paper is illustrated with a number of case histories and a series of charts of the visual fields.

Discussion.—Dr. William H. Wilder, Chicago: In a time of crisis and stress such as these men have all gone thru, it is extremely difficult to differentiate wilful from unwilful manifestations. Possibly it is quite as difficult as it would be in civil life, in the case of an individual seeking damages. It seems to me that some of the manifestations are those of what we might call fatigue of the nervous system,—fatigue that is brought about by what some of the older clinicians used to describe as an insult to the nervous system. Hence, in some of the cases of hysteric manifestations that you see, this may be an explanation. I refer particularly to the peculiar inversion of the color fields seen in hysteric manifestations.

I have seen a case, such as Dr. de Schweinitz mentions, of complete abolition of the color sense, apparently from shell shock. This young man, a soldier, came to me for examination from the Vocational Board of Chicago. He was to be prevented from going into his former vocation, that of an engine man, or fireman, because of complete color blindness. I do not know the previous history, but he stated it as a fact that when in the service of the Rock Island Railroad, which requires careful vision tests of its employes, and perfect color sense, he was absolutely normal for red and green. There were no lesions of the eye discernible. The fundus was perfectly normal, and yet he must be excluded, and probably will be from railroad service on account of his color defect. This is the case that has come under my observation.

Dr. Allen Greenwood, Boston: One of the manifestations of the war neurosis created by "an intolerable situation" is the deplorable fact that some of the men who came to the evacuation hospital had self-inflicted injuries. They were in such numbers that it became quite apparent; and it also became apparent that the condition was more or less infectious, coming at certain times and among certain groups of men. I remember serving as tirage officer of No. 7 Evacuation Hospital one night, and I kept a record of the names of the men and where they came from. During that night, I found twenty-five men who had either shot off the middle or fore finger of the left hand, or shot a bullet between the big toe and the first toe or between the first and second toe. Those were the four principal locations. A few had shot themselves thru the palm of the left hand. I doubt, from my observation, whether these men were really cowards. They came to an intolerable situation, and found that men were being sent back with minor injuries; so they inflicted these minor injuries on themselves.

Another night, when assisting the general surgeon, I did not see such injuries.

Dr. de Schweinitz: The cases that Dr. Wilder has referred to belong to a group that I did not discuss here, altho I did in my paper. They are the so-called ex-

haustion cases, and belong to the psychasthenias. They almost invariably got well by rest, and the condition usually disappeared comparatively soon.

I should like to add just two things more. I spoke of blindness. In a certain number of cases there was a distinct physical reason for the blindness. Some had a disease of the retina. They are referred to in a number of papers—among the rest, Babcock's paper; so it was necessary to decide carefully whether there was an organic lesion. In one case, the only one was a diminutive lesion, like a little cross, right in the macula.

Another thing is that, in the recovery from blindness, it was interesting to observe that the shooting eye was the last to recover. This point is mentioned by Parsons in his article. It was the last eye to accept the suggestion of recovery.

Trachoma in the Camps and Hospitals of the Army.

Dr. Burton Chance, Philadelphia: From his experience in Camp Jackson, he concluded that in the American army trachoma did not constitute a serious problem. His statistics could not be brought to the close of the war since reports covering the latter part of the time had not been issued. During the larger part of the period the records showed that at Camp Jackson, but 35 men had been rejected from the service, and only 26 had been treated for trachoma at the hospital.

Discussion.—Dr. William H. Wilder, Chicago: My impression is that the number of cases of trachoma that we saw in Camp Taylor is considerably larger than that mentioned in Dr. Chance's paper. I do not know how our records went in; but Major Barton, who later became head of the Department of Ophthalmology, after he left the camp, told me that according to the early statistics of 1918, something like two hundred and seventy-five cases had been sent from the camp because of trachoma. This number included some doubtful cases, but not a large percentage; because we early inaugurated the practice there (the Review Board, I mean), of sending back any draftee who had symptoms that we regarded as suspicious. We did not want to keep any such cases for treatment for a number of weeks.

Altho there was a strong effort made by the Public Health Service to have a separate ward set aside for the treatment of these cases, it was deemed inadvisable by Col. Aller; and I thought that was wise. He discharged these men and asked the boards to return sound men. The reason that there was some trachoma in Camp Taylor was that the men there were drawn from Indiana, Kentucky and the southern part of Illinois. Those who are familiar with the Middle States know that there is a great prevalence of trachoma among the native born in the southern part of Illinois. The population there is made up of immigration which came from Eastern Kentucky and southern Indiana in the early days. In that region, between the Mississippi, the Ohio and the Wabash rivers, there is a great proportion of trachoma among the native population. Some of these fellows from Kentucky were cute enough to imagine that they could deceive the surgeon. They set up an inflammation so much like trachoma as almost to lead to their rejection. They produced a conjunctivitis that was extremely puzzling. They would get well; and then, in the course of the day, they would have a marked recurrence. I put my sergeant on one man's track, and he found that the man was rubbing into his eye carbolic acid furnished by a kind druggist at home. Another man, a friend of the first, hesitated to use that, and rubbed in ordinary soap. Another used ordinary camp dirt, and produced a conjunctivitis, which, however, did not have the features of trachoma. These men were taken before a court martial and sentenced to three years at hard labor.

Dr. Nelson M. Black, Milwaukee: In 1918, I was representing ophthalmology in the Surgeon General's Office, and was ordered to the infected districts of eastern Kentucky and Tennes-

see, to observe the treatment instituted by the representative of the United States Public Health Service, Dr. McMullin, and make a report, to be used in the treatment of cases of trachoma in the army. I was also requested to make suggestions to the Quartermaster General's Office as to accepting infected individuals in the draft. The observations that I made, conclusively proved that trachoma, under the treatment instituted by the Public Health Service, could be cured; and in a time sufficiently limited to permit of the man's being available for service. Recommendations were made that a trachoma concentration camp be formed, to which should be sent men from the various camps for observation, treatment and training. The general staff, however, did not see fit to accept these recommendations; so the trachoma concentration camp never developed. However, the next article's reference to acceptance to the draft included trachoma as a remediable disease. Later, that was thrown out; and all trachoma cases were to be rejected. Still later on, they were to be received for treatment in the base hospital, and if not cured in a certain length of time, were to be discharged.

As to the question of the transference of contagion in our armies, I think that the training that the men received in personal hygiene and the establishment of an Ophthalmological Section in the Medical Department of the Army, made the possibility of infecting the army absolutely nil. The men took care of their eyes. If they had eye trouble, they went to the regimental surgeon, who sent them to the field hospital; and from there, they were sent to the base hospital, where, if they had trachoma, it was taken care of. So if a man had trachoma, even in a stage in which infection was evident, there would be no chance to infect the army at large, because of the precautions due to personal hygiene and the establishment of an ophthalmologic department in the army.

(To be continued.)

COLLEGE OF PHYSICIANS OF PHILADELPHIA
SECTION ON OPHTHALMOLOGY

APRIL 17, 1919

DR. WILLIAM T. SHOEMAKER, CHAIRMAN

Bilateral Congenital Entropion.

DR. WM. ZENTMAYER presented an infant upon whose eyes he had performed an operation for congenital entropion of both lower lids. The removal of a crescent of skin with a few of the underlying fibers of the orbicularis had been sufficient to cure the condition. Mayou states that these conditions are never true entropion but a malposition of the cilia. In this case the margin of the lid was rolled in also, so that the cilia were turned down into the cul-de-sac. It may, therefore, be properly termed congenital entropion.

Congenital Pigmentation of the Sclerotics.

DR. ZENTMAYER showed R. C., aged eighteen years, a Russian Jewess. Each eye presents a broad interrupted zone of pigmented sclera reaching from within a few millimeters of the cornea almost to the equator of the globe. The pigment is blotchy and varies from light to dark slaty gray and in places brownish, probably due to the presence of capillaries, as the instillation of adrenalin causes it to lose the brownish color. The skin of the lids is dusky and the veins dilated and dark. The skin of the face shows linear pigment stripes. There are disseminated areas of "port-wine" nevus over the entire body with the exception of the right arm and foot. The ocular fundus has a dark steel-gray hue. The patient is the oldest of five children. None is similarly affected. She had good teeth and has broken no bones. The condition is a pigmented nevus of the sclerotics.

Uveitis with Disciform Opacities.

DR. ZENTMAYER since sending in the title had become convinced that his case was not really one of asteroid hyalitis as he had thought possible at first. The appearance being similar to a dot-

ted veil. There is a patch of exuative retinochoroiditis in the same eye.

Discussion.—Dr. Halloway stated that he agreed with Dr. Zentmayer that the present opacities were those sometimes seen in cases of severe uveitis. Since the publication of his previous report he has seen three cases of these snowball vitreous opacities, the details of which will be published later.

Congenital Ptosis. Motais Operation.

The case was reported to emphasize the value of the Shoemaker modification of Motais's operation. The child was aged five years, and the superior rectus so frail that the difficulties of the procedure would have been unsurmountable had not the open method been used. The result is not perfect but is very good.

Use of Ethylhydrocuprein.

The case presented had been one of severe pneumococcic traumatic ulcer, 7 mm. in diameter, with hypopion. Vision = L. P. The treatment consisted in the use of ethylhydrocuprein, ice compresses and atropin. The result was a corneal scar not as large as the original ulcer and vision = 3/60. Dr. Zentmayer's faith in ethylhydrocuprein strengthens with his experience. Any bactericidal agent to be effective must be, as far as practical, constantly in contact with the organisms. His method of using optochin is to have a 1 per cent solution dropped into the conjunctival cul-de-sac every two hours during the day and every three hours during the night, and to have the ulcer touched with 2 per cent twice daily. A local anesthetic should be used before each application.

Buphthalmos: Results of Posterior Sclerotomies and Optical Iridectomy.

Dr. Luther C. Peter exhibited P. V., aged seventeen months, who was shown at the section about a year ago. Briefly the history at that time was as follows:

The child had a condition of buphthalmos at birth. The corneæ were both very large, blue and the centers of the cornæ were occupied by marked white opacities and granulations. It was pebbly in appearance, with marked juvenile arcus. The anterior chambers were very deep and the iris indistinctly visible thru the cloudy corneæ; pupils dilated to about 4½ mm.; tension of the eyeballs about 35 mm. The scleras are bluish white in color.

Family History.—The parents are Italians, second cousins; one other child, an older brother, is suffering from the same disease and is totally blind, enucleation having been performed on one eye. There are five other healthy children.

Myotics were used the first six months without any apparent improvement. At this time posterior sclerotomy was performed on the right eye without any untoward symptoms and was followed by a marked clearing of the cornea. Subsequently at intervals of two months repeated posterior sclerotomies were performed, four on each eye, followed in each instance by marked clearing of the corneæ, which, however, had a tendency to relapse. By this series of tapping the posterior chamber the tension of the eyes has been kept at about 25 mm. of mercury. Because of the cloudy media the child was developing lateral nystagmus. Optical iridectomies were therefore decided upon and a small section of the iris was removed at the outer limbus in the right eye and the inner limbus in the left eye as the areas in the corneæ offering the best visual results. Very little reaction followed these operations, and the child now is able to see objects fairly small, and the nystagmus has practically disappeared.

The results obtained from this method of treating the patient are satisfactory up to the present time. (1) The corneal opacities were decidedly lessened after each posterior sclerotomy; (2) the tension of the eyeballs was held at about 25 mm. of mercury; (3) the optical iridectomies have decidedly improved central visual acuity and have practically removed the nystagmus which was rapidly developing. The child is kept under observation, and should the tension be in-

creased further, posterior sclerotomies will be performed. One cannot say what the ultimate prognosis will be in this case as the results of the surgical procedures, but the visual results and the general improvement at this time are very satisfactory.

Dr. Zentmayer thought that Dr. Peter was fortunate in the result obtained. From the opinion expressed by many of the ophthalmic surgeons of America it is evident that any operative procedure to be of value must be done early. He recalled that Dr. de Schweinitz had reported successes with posterior sclerotomy, and Dr. Zentmayer believed that, except in the very earliest stage of the disease, this was the only justifiable procedure.

Dr. Holloway stated that in examining this child he had noted that there occurred some reflex sneezing. In his experience this very frequently occurred, and he referred to two children at the Overbrook School for the Blind where this was present to a persistent and excessive degree upon the slightest attempts of the patients to open their eyes. There was intense photophobia in each case. He thought it worth while to comment upon this, not because he regarded it as peculiar to this particular affection, but simply because it is frequently associated with it.

Dr. de Schweinitz stated that his attention had been directed by Haab's recommendation to the value of repeated sclerotomies in the treatment of buphthalmos. He briefly referred to two cases treated by corneoscleral trephining, the operations having been performed not by himself. Certainly in these two cases apparently there was temporary benefit, but he was unable to relate the ultimate outcome of the operations.

Unusual Case of Perivasculitis.

Dr. Luther C. Peter showed Mrs. A. J., colored, aged sixty-one years, housekeeper, who complained that her sight began to fail about three years ago. Her present ocular condition is as follows:

Vision in the right eye is 20/200 and in the left 20/30. Arcus senilis is marked in both eyes; pupils 3 mm. equal in diameter; react to light and accommodation. Eye-grounds: Right eye pupil is oval, long axis, 90 degrees. There are a few fine lenticular opacities and a few floating masses in the vitreous. The disc is 16x18 mm.; long axis, 90 degrees, well defined, excepting at the upper and outer border; edges somewhat obscured. The veins are overfilled and tortuous; arteries are tortuous and light streaks are for the most part absent. The superior temporal branch of the central artery shows a marked perivasculitis. It consists of a broad ribbon-like perivascular tissue thru which a narrow column of blood is visible here and there. About 3 d. d. from the disk the vessel and its branches disappear in a retinal haze, but appear beyond in bifurcations, which are surrounded by narrow borders of white. The terminal branches are exceedingly narrow and tortuous and the macula branch, which is derived from the superior temporal artery, is also a solid mass of white tissue and is lost in a hazy macula area. This temporal vessel, including the macular twig, is at least twice the size of the other branches of the central artery in the neighborhood of the disc. Surrounding the macula is a beginning stellate figure which is regarded as diagnostic of the so-called "albuminuric retinitis." Beneath the macula are a few minute round hemorrhages. Other parts of the fundus show moderate retinal haze and edema and evidences of arteriosclerosis. There are no hemorrhages. The perivasculitis is distinctly confined to the superior temporal branch.

The left fundus is similar in appearance to that of the nasal half of the right retina, characteristic of the fundus usually found in chronic interstitial nephritis.

The fields in each eye show the characteristic contraction for form and color. In addition to this concentric contraction there is a quadrant area of blindness down and in. This quadrant is almost lost for form and totally lost for red, and in a small area to the nasal

side of the field the green test object is recognized as white.

The patient shows a generalized arteriosclerosis. The urine is of low specific gravity and contains an occasional cast and albumin. The blood Wassermann is negative. The clinical medical diagnosis is that of chronic interstitial nephritis, with marked cardiovascular changes.

The case is of unusual interest both because of the imitation of the perivasculitis, the superior temporal branch of the right eye, and also because of its very pronounced appearance and the abundance of the perivascular tissue. As to the immediate etiologic factor, embolic or thrombotic processes can be safely eliminated. The condition undoubtedly is a perivascular change, arteriosclerotic in origin and associated with chronic interstitial nephritis.

Dr. de Schweinitz agreed with Dr. Peter that the vascular changes in his patient were not the result of an embolic process, and thought they represented lesions in association with arteriosclerosis and nephritis. He assumed that the influence of syphilis had been eliminated. He described a case of extensive retinal vasculitis and perivasculitis in a colored man which he had reported, and which was almost certainly due to syphilis, and referred to the fact that it had seemed to him that such vascular changes were apt to be more pronounced in the colored than in the white race.

Sudden Loss of Vision from Acute Sphenoiditis, Recovery.

Dr. H. Maxwell Langdon presented the history of this case because of the three cases reported by Dr. D. T. Vail in the AMERICAN JOURNAL OF OPHTHALMOLOGY for February, under the title, "Monocular Retrobulbar Optic Neuritis from Hyperplasia of the Ethmoid Bone." Dr. Langdon's case was very similar to them except that the sphenoidal sinus was involved instead of the ethmoid. Mrs. M. B. W. was first seen on January 23, 1917, with the following history: She had had grip, with much pain around the right eye and brow for the preceding ten days. O. D. vision blurred the past two days.

Externally the right pupil was 4 mm.; no reaction to direct light, but a good consensual response. The left pupil was 2.5 mm.; good direct reaction; no consensual reaction. Each acted well to accommodation. The ocular rotations were full in all directions. O. D. vision. Fingers at one foot. O. S. vision 6/10. The media were clear; the right disc somewhat hyperemic with blurred nasal margins; the left disc was normal; there were no other fundus changes. The right field was gone except for an irregular light field, and the left field was normal except for a slight contraction for colors.

Dr. G. B. Wood examined the nose and found no evidence of sinus involvement except some slight congestion of the right middle turbinate; an X-ray investigation made by Dr. H. K. Pancoast was negative except for some clouding of the left antrum.

Later, Dr. Wood again examined the nose, and after applying cocain to the right ostium sphenoidale there was a sudden improvement in vision, the patient seeing the pattern on the floor covering. Dr. Wood then removed the posterior end of the right middle turbinate and drilled a small hole thru the front wall of the sphenoidal sinus without finding any pathologic secretion. The vision improved with washing of the sphenoid, until on the tenth day after the first operation the vision was 6/15, and with no treatment other than nasal. The disc hyperemia disappeared and there were no further complications, corrected vision being 6/5.

That this was an involvement of the optic nerve from a sphenoidal sinuitis seems beyond all doubt, and yet there was no pathologic secretion on tapping the sinus and no shadow on an X-ray plate from a cloudy content of the sinus. It seems there must be a form of involvement which gives a clear secretion, at least in the early stages, for this case was attacked as soon as the vision was disturbed. It opens up an interesting point as to

whether Dr. Vail did not have something of the kind involving the sphenoid rather than hyperplasia of the ethmoid bone.

Dr. de Schweinitz briefly discussed a case of acute retrobulbar neuritis which had been examined and described by Dr. W. R. Parker, where there had been sudden improvement in vision after the free use of adrenalin in the nasal chambers, which had apparently started drainage and thus relieved pressure on the optic nerve. He questioned whether negative X-ray examinations and investigation of the nasal chamber in the sense of failure to find purulent secretion were sufficient to exclude the presence of some types of ethmoiditis which might be the cause of optic nerve changes. He referred to the fact that unilateral intraocular as well as retrobulbar neuritis were strongly suggestive of sphenoidal or ethmoidal infection.

Hypopyon Ulcer of Cornea Treated by Chauffage.

Dr. H. Maxwell Langdon related the case of W. M., who was first seen February 2, 1919, with the history that on February 22, while digging a street excavation, a piece of asphalt struck him in the right eye, since which time the eye had been sore. The eye was slightly injected, and there was a corneal ulcer, about 3 mm. in diameter, slightly to the upper, outer side of the pupil. The ulcer was touched with carbolic and a bandage was applied, the pupil dilating readily with atropin. The ulcer spread slightly, but was checked by further carbolization, tho the center would not heal and there was steady increase of the hypopyon until the lower half of the anterior chamber was filled, and it was determined to try the effect of radiant heat. A galvanic cautery was heated until a thermometer held over it registered 145° F., and when held below the cautery registered 125°; as the eye was below the instrument, this is the temperature applied, the eye having been thoroly cocainized. It was held as close to the eye as possible, avoiding contact, for a minute, then away for three minutes, during which time the eye was irrigated with salt solution; the application was repeated twice at the same sitting. In twenty-four hours the hypopyon was beginning to absorb, the iris at the lower outer portion of the anterior chamber becoming visible. The improvement was uninterrupted until the hypopyon is now entirely absorbed and nothing remains but a moderately dense scar near the center of the cornea, due probably as much to the repeated use of carbolic acid as to the heat. Had the heat been used sooner it seems most likely that the scar would have been much less.

This heat was applied, of course, after the method described by Weekers, and not in the way Shahan advises, one of his thermophors not being available.

Dr. de Schweinitz, altho he had had no personal experience with Dr. Shahan's thermophor in ophthalmic practice, referred to reports he had received of its value in the treatment of infected corneal ulcers in the service of U. S. General Army Hospital No. 14, at the time of the report in charge of Dr. Meyer Wiener.

Dr. Holloway stated that he regarded Dr. Langdon's result with chauffage as excellent, but he felt that it was worth while emphasizing the important work which had been done in this country by Shahan in placing the application of heat to the eye upon a somewhat more scientific basis. Unfortunately, Shahan's instrument was not available at the present time, and until this could be secured it would be necessary to use some of the other methods, which while they doubtless give satisfactory results are by no means as accurate in determining the actual degree of heat applied.

J. Milton Griscom, M. D.,
Clerk.

American Journal of Ophthalmology

Series 3, Vol. 2, No. 9 September, 1919

PUBLISHED MONTHLY BY THE OPHTHALMIC PUBLISHING COMPANY

Original papers and books for review may be sent to any member of the editorial staff. Reports of society proceedings, correspondence, and other scientific communications should be addressed to the Editor.

Proof should be corrected and returned within forty-eight hours to the printer. Reprints may be obtained from the printers, Tucker-Kenworthy Co., 501 S. La Salle St., Chicago, Ill., if ordered at the time proofs are returned.

Subscriptions, applications for single copies, communications with reference to advertising or other business, should be addressed to
H. A. FOX, Manager, 7 West Madison St., Chicago, Ill.

THE BELGIAN SOCIETY OF OPHTHALMOLOGY.

After more than five years intermission necessitated by enemy occupation, the Belgian Society of Ophthalmology held its reopening meeting on the 29th of June, 1919, with Professor J. Coppez as president.

In his address of welcome Professor Van Duyse, the general secretary, paid tribute to the members of the society, who on the one hand, devoted themselves to the cause of law and justice in the army, and on the other, rendered signal services in the occupied territory.

The following resolutions of the officers of the society were adopted:

"The bureau of the Belgian Society of Ophthalmology, reunited in the meeting of June, 1919, at Brussels, takes cognizance of the facts disclosed by a letter of the Academy of Science of Belgium, of the 20th of January, 1919, and by various documents, which give evidence that the German scientific and university world approved the deeds of the Central Powers, against us and against our allies. These deeds, contrary to all civilized usage, became familiar to the population of occupied territory during the world war, and they remain an ineffaceable stain upon conquered Germany.

Therefore the bureau of the Belgian Society of Ophthalmology engages that its members:

1. Withdraw from German and Austrian scientific societies and give up all collaboration with Germans and Austrians.

2. Exchange no publications and have no intercourse with the Central Powers.

3. Renew scientific intercourse with the enemy only when they prove by public declaration that they condemn the mentality of those who signed the manifesto of October, 1914."

Correlative to this order of the day, the assembly announced the removal of the names of German and Austrian honorary members and correspondents from its lists.

Professor Coppez received congratu-

lations upon the completion of fifty years of professional service. The secretary recalled to the society that Professor Coppez was the founder of the science of ophthalmology and its teaching in Belgium. Moved by the demonstration, Professor Coppez replied that it was to the French masters of the science, past and present, that such recognition was due.

M. DANIS.

THE ETIOLOGY OF MYOPIA.

The relation of the sclera to the skeleton, which is mentioned in the paper by Ochi is suggestive of thought, and a subject for investigation that may have very practical results in improving the management of myopia. The bony skeleton is, of course, but a part of the general connective tissue frame work, which supports all parts of the body. The peculiarities of structure and the deposit of lime salts that characterize bone, easily arise in parts of this connective tissue framework that usually remain soft, as in anomalous sesamoid bones, or the "pully" of the superior oblique muscle.

The congenital anomaly manifest in "blue scleras and brittle bones," which association has occupied an important place in the recent literature of ophthalmology, seems to be an illustration of the close relation between the sclera and the bony skeleton as to essential conditions of nutrition. Other evidence of such a relation is worth looking for, and is likely to prove equally suggestive.

It is some 27 years since R. D. Batten suggested the hypothesis that the occurrence and development of progressive myopia depend on a nutritive defect in the sclera, which he associated with constitutional and especially cardio-vascular disease. The association is still worth considering.

Subsequently Batten wrote on the association of myopia with nasal disease. Risley has reported many cases illustrating the connection of myopia following ocular congestion produced by eyestrain, especially by the strain incident to eye work with uncorrected astigmia. There are extensive statistics connecting myopia with use of the eyes for near work.

The theory ascribing myopia to a peculiar form of the orbit by which oblique muscles, especially the superior, were made to exert especial compression on the eyeball; the compression of the posterior ciliary vessels in convergence; or of vortex veins by the inferior oblique muscle; the defective closure of the scleral fissure, the overdevelopment of the human cranium and consequent modification of the orbit have all been invoked as the predisposing causes of myopia.

There has been too much theoretic argument, and not enough careful, exact observation regarding this subject. The statistics need more careful sifting. The different hypotheses need the consideration of unbiased judges, not further exploitation by special pleaders.

The development of myopia needs to be considered broadly. Evidently it depends on a disturbed balance of nutritive forces. Every factor that bears upon those forces may be important in destroying their balance. All are worthy of consideration, and must be considered judicially before the true share of influence can be ascribed to any one of them.

If a school girl develops myopia, has she astigmia? Is she converging excessively? Is there a sclero-choroiditis present? Has she vascular or nasal disease? Is there evidence of defective nutrition in other directions, particularly of skeletal and connective tissue structures? When we can answer all these questions, we may be able to assign to each factor its proper share in the result. Meanwhile we must devote attention to all those remedial conditions that seem likely to be important factors in producing elongation of the eyeball.

E. J.

TO AVOID PROFESSIONAL RUTS.

Specialization, repetition, and habit make for accuracy, rapidity, and easy accomplishment. But they also have dangers in the way of narrowness, fixed routine, and unfitness to deal with new situations and overcome new difficulties.

The specialist has more need than his less differentiated colleague to keep a broad interest in the general field of medicine, and to have his everyday problems presented from new points of view.

Every practitioner of medicine needs to leave his daily round at times to see how others do their work, to learn that his own familiar problems can be approached from a different angle, and dealt with by different methods. To the specialist such escape from his daily routine is absolutely necessary, if he is to continue an intelligent, rational, up-to-date, practitioner of his specialty.

No matter how highly we may specialize, there remains some variety in our work. To the ophthalmologist, the many contacts of ophthalmology with general medicine and surgery are precious opportunities to get away from routine in our examinations; and to approach questions of disease from a more general point of view. Reading is another channel in which to get someone else's line of thought, even on the most common conditions we have to treat; and it is well thus to get into other branches of medicine, and consider their more important problems in pathology; while we welcome every opportunity to consider the most common diseases with which we have to deal from a new standpoint.

Another war may never bring the problems of alien labor companies. But Dr. Derby's account of how trachoma was dealt with among them under military emergencies contains valuable suggestions at to how men may be inspected, and watched in mines, large manufacturing plants, or construction works. The experience that made zinc sulphat solution the "universal drops" in that service, gives a hint of what may be possible in trachoma infested communities.

No reader of this JOURNAL may ever be called upon to organize an ophthalmic service for expeditionary forces; but the plan for the eye clinic, the list of equipment required, the experience of the relative importance of refraction work in a modern army, the essentials of diagnosis and treatment brought out and emphasized in the army circulars given last month, may be more helpful than a repetition of the requirements, and teaching in the offices or clinics we have actually worked in.

The accounts given by Duane and Howard of the exact visual requirements for the signalman, and the aviator should stimulate thought and prove suggestive as to the strains put upon the eyes of our patients, the needlewoman, the bookkeeper, the mechanic or the miner. It is the same organ that is required to give service in all these different directions. Each use of it has its own peculiar form of stress and danger, but all we can learn about it under one set of conditions is of possible value in helping to understand its dangers under other conditions.

Even the reading of crude and obviously injudicious methods of treatment, or poorly planned or unnecessary methods of operating, can help the thoughtful ophthalmologist to get a better appreciation of his own therapeutic methods and operative resources. Wherever we can find an intelligent, honest report of what has occurred in an eye placed under unusual conditions, it is worth reading and thinking about. The exigencies of war have presented familiar problems in a new light to those who entered military service; and thru their reports of their experience, to ophthalmologists everywhere. Our war literature will soon pass or cease to be current. Let us get the most out of it that we can while it lasts. It may take some thought to apply its lessons to our ordinary problems, but that kind of thinking is always a good exercise.

It is the aim of this JOURNAL to draw

its contents from the widest possible sources. On this account we welcome contributions from all parts of the world, from the laboratory worker or the physicist as well as from the master of the large ophthalmic clinic. Especially welcome is really good work on the part of a new writer. Each individual approaches our common questions and difficulties in a slightly different way that is more likely to be helpful than the repeated statements of an old teacher or a familiar writer.

The most efficient, resourceful, successful ophthalmologist will be he who keeps from forming ruts in his thinking and methods of practice, in which he would travel along contentedly until he lost the power of turning his thought in new directions. We therefore urge our readers to utilize the war papers now being published, and discussions, particularly those of the American Ophthalmological Society, to get this view of eyes and their shortcomings different from the one forced on our attention by our daily routine of practice.

E. J.

CORRESPONDENCE.

Trachoma on the Pacific Coast.

To the Editor:

Referring to an article under the above title in the June number of the AMERICAN JOURNAL OF OPHTHALMOLOGY, by H. V. W., I beg leave to amend the title by having it read, "The Relative Scarcity of Trachoma on the Pacific Coast *at the Present Time;*" also to call attention to the fact that thirty years ago conditions in the northwest were quite different from what is found at the present time; then there was no dearth of trachoma.

The Puyallup, Nisqually and other tribes of Indians were badly infected. Twenty-five years ago the Reservation School near Tacoma, now the Cushman Indian School, having as it does, children and youths from many tribes, even as far east as Montana, had a severe epidemic of trachoma. Dr. P. B. Swearingen, then resident physician, called the writer to his assistance to treat the cases and arrest the epidemic. We fought the disease for several years and very nearly stamped it out, both in the school and among the members of the Puyallup tribe. The number afflicted ran into the hundreds.

Thirty years ago trachoma was also prevalent among the white population of Tacoma and Puget Sound; many Swedes and Norwegians came from the Middle West and settled in the city and surrounding country. A large number of these people brought the disease with them and transmitted it to their children and grandchildren. The public school children of other families contracted the disease, and from 1890 up to 1910, there was a great deal of it. But after the rush of immigration was over those affected came under treatment, precautions were taken in the schools, common towels done away with in shops, lodging houses and homes, where there were sore eyes, and there began to be a falling off in the frequency of its occurrence. During the last ten years of my practice in Tacoma, it became rather an uncommon disease. Whether the climate had any influence over its control is a question.

East of the mountains the disease was never prevalent either among the Indians or white people, as it was formerly on Puget Sound. At the same time there has been among the Indians of Yakima less opportunity for proper care and treatment, owing to the distance from medical aid, and to a less degree of civilization. There is more dust and dirt and flies, but the Indians live in the tepee and open as much if not more than those of the coast country. I know little of the conditions east of the Rockies except such as I gained from children in the Cushman School, who came from Montana. I found none afflicted with trachoma.

Personally I am of the opinion that better treatment and care until complete recovery was assured, better sanitary conditions, better knowledge of the disease among the laity, have had more to do with its control in all walks of life, and among all nationalities in

the Northwest, than climate. The disease has gradually diminished during the last thirty years, as a result of care, sanitation and proper treatment.

Perhaps if H. V. W. returned to Milwaukee he would find the same results there, and not the conditions of thirty years ago.

P. B. WING.

San Diego, Cal.

An Improved System of Illumination for the Electric Ophthalmoscope.

To the Editor:

Under the above title the writer of this letter read a short paper at the Fifty-fourth Annual Meeting of the American Ophthalmological Society held at New London, 1918. He described the system, which had been constructed under his guidance by the well-known inventor of electrical and optical instruments, Mr. R. H. Wappler; he developed its theory and explained its advantages. In the discussion Dr. Walter E. Lambert asked him how this system of illumination differed from "Dr. May's Ophthalmoscope," to which he replied that the answer was easy. There was no difference whatever. This illuminating system had been "incorporated" into the "May Ophthalmoscope," without his knowledge and consent, and had gone forth into the world as the "May Ophthalmoscope."—For surely the essential part of an ophthalmoscope is the illumination, and not the disc or other nonessential parts.

In the May number of the AMERICAN JOURNAL OF OPHTHALMOLOGY appeared a lengthy letter by Dr. May, in which he denies the truth of my statement, and says: "I wish emphatically to state that I owe nothing to either Dr. Koller or to Mr. R. H. Wappler in connection with this instrument."

The following statement by Mr. R. H. Wappler, senior member and President of the Wappler Electric Company, the very concern which manufactures and sells "Dr. May's Electric Ophthalmoscope," will suffice to clear the fog and end this controversy.

New York, June 4, 1918.

I certify that Dr. Koller and myself have collaborated between 1910 and 1912 on the construction of an illuminating system for an electric ophthalmoscope, and that with his help and under his guidance I have constructed the system, which has been incorporated in the "May Ophthalmoscope," manufactured and sold by the Wappler Electric Company.

Signed. R. H. WAPPLER.

Witness: C. JOHNSON.

This clear and unequivocal statement leaves no room for any controversy, and shows that the essential part of "May's Electric Ophthalmoscope"—the illuminating and reflecting system—is not Dr. May's work.

CARL KOLLER.

New York, June, 1919.

(In medical literature priority of publication is the only priority that can be recognized. In closing this discussion it may be timely to remark that discussions as to the priority are always unsatisfactory and generally unprofitable.—Ed.)

BIOGRAPHIC SKETCHES.

THOMAS H. SHASTID,

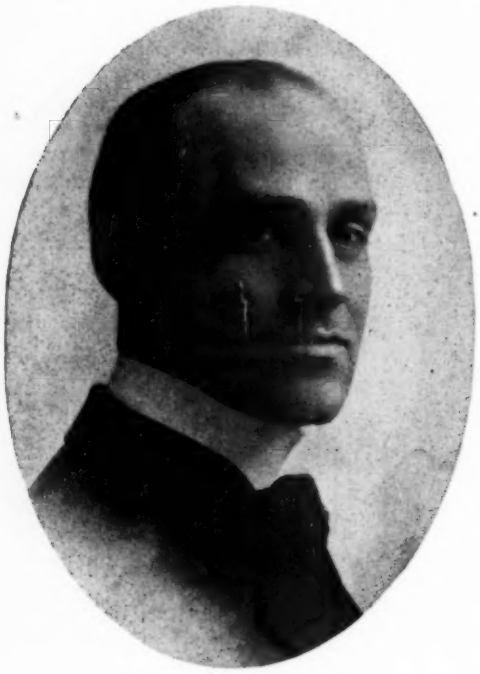
SUPERIOR, WISCONSIN.

WILLIAM KNISELY CHERRYHOLMES. This well-known ophthalmologist of Hamilton, Ohio, died on March 31, 1919, of influenza. He was born at Millersburg, Ohio, in 1861, received the A. B. at the Ohio State University in 1882, and the M. D. at the Bellevue Hospital Medical College in 1884. For a time he practiced general medicine in partnership with his brother-in-law, Dr. Wise, at Millersburg. Later, he was special examiner in the Pension Bureau at Washington, D. C. He settled in Hamilton in 1892, specializing in ophthalmology and oto-laryngology, where he practiced until his death.

MORTIMER FRANK. This well-known ophthalmologist and medical historian died at his home in Chicago on April 21, 1919. He was born at Buffalo, N. Y., May 26, 1874, received the B. S. at

the Boston Institute of Technology, and the M. D. at the University of Illinois in 1901. Having practiced general medicine in Chicago for a year, he studied ophthalmology in Philadelphia, New York, Paris and Vienna.

Returning, he settled as ophthalmologist in Chicago. He was a Fellow of the American Academy of Ophthalmology and Oto-Laryngology, ophthal-



Mortimer Frank, 1874-1919.

mologist to the Michael Reese and other hospitals, secretary of The Chicago Society of Medical History, and editor of the same society's "Bulletin." In medical history the Doctor was, in fact, an enthusiast, and his library of old and rare medical books and engravings numbered several thousand items.

Among the more important writings of Dr. Frank we may mention "John Taylor and Sir William Read" (1905); "The Resurrectionists" (1907); "Philip Syng Physick" (1914); "Caricature in Medicine" (1911); "Biographical Sketch of Some Representative Ophthalmic Surgeons" (in Wood's "A System of Ophthalmic Operations," 1911, I, p. 17); "Medicine in English Literature Before the Eighteenth Century" (1912); "Medical Instruction in the Seventeenth Century" (1915); "Discovery of the Secretory Glands" (1916), and an English translation of Choulant's "History of Anatomical Illustration" (forthcoming). Concerning the last named work, Dr. F. H. Garrison, of Washington, D. C., in a letter to "The Journal of the American Medical Association," May 24, 1919, p. 1562, says: "Dr. Frank's interest in the subject of medical illustration led him to undertake, in 1916, the translation of Choulant's 'History of Anatomical Illustration.' This book, published in 1852, is one of the classics of medical literature, a work of unsurpassed thoroness, a sort of *Gradus ad Parnassum* for those who would essay the difficult heights which Choulant has scaled, for the earlier history of anatomy, from Leonardo to the time of Bichat, is mainly in the manuscript illustrations and the illustrated text. In our days of distracting and dividing interests, no man could hope to know the approaches to anatomy in the older writings who had not mastered at least the essentials of this book. Few of us would have cared or dared to attempt such a translation. Choulant is a work of the highest scientific merit, but, in the original German it is not a readable book. Its author wrote in the time of Hegel, his bent was philosophic, his sentences of the sesquipedalian order, like the 'long rollers' in Gibbon or Swinburne, or the prosy periods voiced from the pulpit in the Georgian period. Dr. Frank cleverly overcame the almost insurmountable difficulties of rendition by bisecting the long Choulantian sentences or dissecting out their meaning, so that his translation now stands, in clean-cut intelligible English, as something viable and readable for modern students. To the original work, long since out of print, the translator added completed biographies and an exhaustive *compte rendu* of accumulated research work since the time of Choulant, a man-sized performance in itself. With new illustrations, this modernized Choulant, now in the hands of publishers, may be, in course of time, a

vade mecum for the professor of anatomy, the medical librarian and the art school."

Dr. Frank was a tall, lean man, smooth faced, of fair complexion and with light brown hair and blue eyes. He was quiet and deliberate in manner as a rule, but cordial to his friends and a "romp" among children. Nothing delighted him more than to exhibit his medico-historical library to those who loved such things, and the writer recalls with pleasure an all-too-short forenoon spent with Dr. Frank in his magnificent treasury of rare volumes. The Doctor was very public spirited, a Director of the Chicago Public Library, a liberal in politics, a member of the Jewish Reformed Church. He married on Oct. 4, 1905, Donie K. Frank, by whom he had two children—Katharine Jane and Mary Elizabeth.

We cannot do better than close with words of Dr. Garrison: "Dr. Frank was a sportsman and a gentleman, a thoroughly likable and lovable man, a very faithful and loyal friend. To those who knew him well it will always seem triste and unthinkable that he should have been cut down in his prime, just before the appearance of the book to which he had devoted so much of praiseworthy competence and such ardors of patient research."

SAYER HASBROUCK. A well-known homeopathic ophthalmologist and otolaryngologist. Born at Middletown, N. Y., June 3, 1860. He was a son of John W. Hasbrouck, a well-known journalist, and Lydia Hasbrouck, daughter of Benjamin Sayer, of Warwick, N. Y. Dr. Hasbrouck in 1875 entered Cook Academy, at Havana, N. Y., where he graduated in 1879. In the fall of that year he entered the Boston University School of Medicine, graduating in 1882.

For a time Dr. Hasbrouck was physician to the New York Homeopathic Insane Asylum at Middletown. Then he went to Dublin, Ireland, and entered the Rotunda Hospital, at the same time studying the eye, ear, nose and throat at St. Mark's Ophthalmic Hospital. Receiving the degree of L. M., he was for a short time house surgeon at St. Mark's. After this he studied the eye, ear, nose and throat at Belfast, Glasgow, Edinburgh and London. At the Royal London Ophthalmic Hospital (Moorfields) he was assistant to Sir George Lawson, and at Gray's Inn Throat and Ear Hospital, to Dr. Hamilton.

After a little study on the Continent he returned to America in 1884 and settled at Providence, R. I., as ophthalmologist and otolaryngologist. He was soon widely known in homeopathic circles.

Dr. Hasbrouck married, on September 25, 1889, Mary Owen Fiske, daughter of John T. Fiske, of Chepachet. She died on February 14, 1906, leaving a daughter, Miss Fannie Fiske Hasbrouck, who now lives in New York City. Dr. Hasbrouck later re-married, but the name of his second wife could not be learned by the present biographer.

Several years ago, Dr. Hasbrouck's health began to fail, and he removed to Hamilton, Bermuda. There he resided until his death, which occurred on March 24, 1919.

NEWTON C. STEELE, professor of diseases of the eye, ear, nose and throat in the Chattanooga Medical College, died at his home, March 9, 1919, from pneumonia. Born at Athens, Ala., in 1850, he received the medical degree at the University of Nashville, Nashville, Tenn., in 1873. For a time he practiced at Corinth, Miss., but soon removed to Chattanooga. Here he practiced as ophthalmologist and otolaryngologist until his death—a period of more than thirty years. His only son, Dr. Willard Steele, was a partner with him for the last few years of his practice. Dr. Newton C. Steele is survived by a wife and two children, Dr. Willard Steele and Mrs. W. D. Carswell.

FRANK VAN FLEET. The world of ophthalmology was shocked to learn of the death of this distinguished ophthalmologist, who was found dead in his office at 17 East Thirty-eighth street, New York City, on April 5, 1919. Born in New York City on March 31, 1860, son of Henry S. and

Esther Flandreau Van Fleet, he received his medical degree at the Bellevue Hospital Medical College of New

Frank Van Fleet, 1860-1919.

York City, in 1881. Settling in New York as ophthalmologist, he soon had an extensive practice and a wide reputation.

He was executive surgeon to the Manhattan Eye, Ear and Throat Hospital for seventeen years, and at the time of his death was president of the Board of Surgeons of the same institution. He was a Fellow of the New York Academy of Medicine and of the American College of Surgeons, and was once President of the New York County Medical Society. He was also Treasurer of the New York State Medical Society and chairman of the legislative committee of that body for very many years. During the war he gave much time to the examination and treatment of soldiers whose eyes had been injured by poisonous gases. He wrote so many articles that they cannot here be listed.

Dr. Van Fleet was rather a stout man, 5 feet 6 inches high, of a fair complexion and with blue eyes and blonde hair. As a rule he wore a mustache. He was very quiet, but courteous and friendly. He was a Republican, a member of the Methodist Episcopal church, a hard student of the Bible, a very devout Christian.

The Doctor married in 1883 Carrie Blair Oakley, by whom he had three children — Harry, Raymond Oakley and James Flandreau. The latter is now a lieutenant in the Medical Corps of the Navy.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply the news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. H. Alexander Brown, San Francisco; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. Geo. H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Guatemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago; Dr. John E. Virden, New York City; Dr. John O. McReynolds, Dallas, Texas; Dr. Edward F. Parker, Charleston, S. C. Volunteers are needed in other localities.

DEATHS.

Andy Jackson Stewart, aged 46, a resident of Provo, Utah, died at his home, from pneumonia, on May 25.

Lord Reyleigh, scientist, of Essex, England, died June 30, aged 76 years.

PERSONALS.

Col. J. Herbert Parsons, London, has received the C. B. E.

J. Meller has succeeded S. Bernheimer in the Vienna Eye Clinic.

G. E. Burroughs has been appointed ophthalmic surgeon to the Liverpool Royal Infirmary.

Col. W. T. Lister has been appointed surgeon-oculist to the H. M. Household, and has received the K. C. M. G.

Dr. H. D. Lamb, St. Louis, passed thru Denver on his way home, after spending his vacation in the mountains.

Dr. Adolph Barkan has returned to San Francisco after an absence of eight years spent in Germany and Switzerland.

Dr. Francis Lane, of Chicago, who has been suffering from an attack of appendicitis, will go to Flagstaff, Arizona, for a month's vacation before resuming his practice.

Col. Walter B. Lancaster, of Boston, was in Denver a few days ago en route to California. It is always a pleasure to meet Dr. Lancaster anywhere, but especially in our "own home town."

Dr. José Joaquin has recently published a study of the prevalence of blindness and its distribution and causes in Mexico, which does credit to his ability to ferret out such matters.

MILITARY NOTES.

Dr. George E. Bellows has returned to civil practice, and is located at 1010 Rialto building, Kansas City, Missouri.

Capt. W. T. Brinton has just returned from overseas service to resume his practice at Cripple Creek, Colorado.

Dr. George S. Crampton, Lieut.-Col., M. C., U. S., Army, after fourteen months' service with the 28th Division overseas, has returned to his home in Philadelphia.

Capt. Frederick T. Clark, of Westfield, Massachusetts, who since last March has been chief of the ophthalmologic service at U. S. Army General Hospital No. 1, New York City, has been promoted to major and made chief of the combined ophthalmologic and oto-laryngologic services.

Major William Humes Roberts, who went to France as chief of the eye and ear service of Base Hospital 93, has been discharged from service and has reopened his offices at 461 East Colorado street, Pasadena, California. During the latter months of his stay in France, Dr. Roberts was eye consultant of the Justice Hospital Group in Toul.

SOCIETIES.

The American Academy of Ophthalmology and Oto-Laryngology will meet at Cleveland, Ohio, October 16, 17 and 18.

The Sioux Valley Eye and Ear Academy met in Omaha July 22, 1919, at the Hotel Fontenelle. This society is composed of members from Iowa, Nebraska and South Dakota. They had a short, snappy program and the meeting was well attended.

At the completion of the summer course on ophthalmology, held in Denver August 4 and 5, under the auspices of the Medical Department of the University of Colorado, the Colorado Congress of Ophthalmology held its annual meeting. This year the oto-laryngologists participated in the program and contributed largely to the success of the meeting. Dr. Arnold Knapp of New York was present as the guest of honor. The last evening was devoted to a mountain auto trip and dinner at the Mountain Home of the Automobile Club.

Indiana Academy of Ophthalmology and Oto-Laryngology held its regular semi-annual meeting May 28 and 29, at Indianapolis. Officers elected: President, W. S. Tomlin, Indianapolis; vice-president, F. G. Hackelman, Rushville; second vice-president, Fred McK. Ruby, Union City; secretary-treasurer, B. J. Larkin, Indianapolis; councilors—for three years, E. J. Lent, South Bend, and J. W. Hadley, Frankfort; for one year, T. C. Hood, Indianapolis, and G. H. Smith, Newcastle. Six papers were listed on the program. The morning of the second day clinics were held at St. Vincent's Hospital. Thirty-two were present. Next meeting will be at South Bend.

The seventh annual meeting of the Pacific Coast Oto-Ophthalmological Society was held in San Francisco August 4, 5, 6.

The scientific program was carried out each afternoon in the assembly room of the San

Francisco County Medical Society in the Medical building. Dr. Cullen F. Welty, president of the society, presided at all the sessions. The mornings were devoted to operations and clinical demonstrations by the local men in the leading hospitals of the city.

Dr. W. L. Clark of Philadelphia, who was expected to give demonstrations of his high-frequency treatment of malignant growths, was unable to be present.

The papers presented during the session were unusually good and afforded keen discussion generally.

The visitors were well entertained by luncheons daily at the leading places in San Francisco. A reception was given by Dr. Welty, the president, at his home on Monday evening, and a dinner dance was given at the Fairmont Hotel on Tuesday evening by the Eye, Ear, Nose and Throat Section of the County Medical Society. A matinee party was given for the ladies at one of the leading theaters on Wednesday afternoon, which was followed by an automobile trip to the San Francisco Golf and Country Club, where the members and their wives had tea.

The 1920 meeting will be held in Portland, Oregon, and will be presided over by the new president, Dr. Wilson Johnston, with Dr. Frank B. Kistner as secretary-treasurer.

The society voted a sum of $250 to be put aside yearly towards the expenses of some man of international reputation who will appear before the society and give demonstrations, operative or otherwise.

The tenth annual meeting of the Oxford Ophthalmological Congress was held on July 10 and 11 last, in beautiful weather. Members were lodged in Keble College and the scientific proceedings took place in the Department of Human Anatomy of the University (kindly lent for the purpose by Professor Arthur Thomson), where technical and commercial museums were also arranged.

The program was opened on July 10 by an address of welcome by the master, Mr. Sydney Stephenson. Major Walter H. Kiep, R. A. M. C., read a paper on the "Ocular Complications of Dysentery," which was followed by a good discussion on the subject. Major Edgar H. Smith, R. A. M. C., read a communication dealing with "Quinin Amaurosis," well discussed by the members present. Dr. William McLean, of New York, described his further experimental studies in intraocular pressure and tonometry, and exhibited his latest model tonometer.

Preventive ophthalmology was introduced by Col. J. Herbert Parsons, C. B. E., consulting ophthalmic surgeon to the forces. Colonel Parsons pointed out that the scope of his subject dealt with the prevention of damage (a) to the individual, and (b) to others. (a) Included many subjects, such as prevention of damage to the eyes from accidents, defective illumination, deleterious rays and organisms, and the prevention of damage to health from headache, accident, fatigue, etc.; (b) included regulations for the prevention of the transference of contagious disease and rules for navy, army, air force, mercantile marine, railway, motor industry, cinemas, and so forth. The problems of preventive ophthalmology constituted a question of collective action, and were of particular value at the moment, when projects of reconstruction were to the fore. In connection with the prevention of accidents to the eyes in factories there is urgent need for a scale of awards for compensation founded upon scientific principles. The formulation of regulations for the public services demanded (1) a widening of the basis of education of ophthalmologists; (2) cooperation between ophthalmologists and other experts; and (3) improvement in the methods of examination of candidates and the selection of examiners.

After the discussion, the Doyne Memorial medal was presented to Colonel Parsons by the deputy master, Mr. Philip H. Adams. In the afternoon members and their friends were entertained at tea in the gardens of Trinity College by Mr. D. N. Nagel, M. A., and Miss Nagel. In the evening the annual dinner of the congress was held in the hall of Keble College, some seventy members and visitors being present. The toast list was commendably brief.

After dinner the annual general meeting of the congress was held in the junior common room at Keble College. Among other things, it was determined, on the motion of Mr. J. B. Story, to make representations to the General Medical Council in support of those recently referred to that body by the Council of British Ophthalmologists concerning the instruction and examination of medical students in eye work. Readers of the LANCET are aware that the recommendations in question have been rejected by the General Medical Council.

On July 11 the proceedings began with a paper by Dr. S. Lewis Zeigler of Philadelphia, on the "Problem of the Artificial Pupil; Knife Needle versus Scissors." Dr. P. Bailliart of Paris followed with a communication dealing with his dynamometer for determining the blood pressure in the branches of the central retinal artery. Mr. A. F. MacCallan (Cairo) read a paper on the "Seasonable Variations of Acute Conjunctivitis in Egypt." Col. A. H. Tubby entered a suggestive plea for investigation as to any possible connection between skeletal assymetry, on the one hand, and defects of the eye on the other.

A discussion upon employment for the blind was introduced by three blind speakers, namely, Mrs. Adolphus Duncombe, Capt. Peirson Webber and Captain Towse, V. C., and it is to be hoped that useful action will be undertaken by the congress in connection therewith.

In the afternoon the Ashhurst War Hospital at Littlemore, near Oxford, was thrown open to members by Lieut.-Col. T. S. Good, R. A. M. C.

OPHTHALMIC LITERATURE

These lists contain the titles of all papers bearing on Ophthalmology received within the preceeding month. These titles are all in English, some of them modified to indicate more clearly their subjects. These subjects are grouped under appropriate heads, the succession of groups being the same from month to month. In the group the papers are arranged alphabetically usually by the name of the author in heavy-face type. After the subject of the paper (Ill.) indicates the number of illustrations. (Pl.) the number of plates, and (Col. pl.) colored plates illustrating the article. (Abst.) shows that it is an abstract of the original article. (Bibl.) tells that the paper is accompanied by an important bibliography. (Dis.) means that a discussion of the subject is published with it. Under Repeated Titles are indicated additional publication of papers already noticed. To secure the earliest possible notice writers may send copies of their papers, or reprints, to 318 Majestic Bldg., Denver, Colorado.

DIAGNOSIS.

Hertel. Military Tests of Eye Changes. Strassburg med. Zeit., 1917, v. 3, Abst., Centralb. f. prakt. Augenh., 1919, v. 43, p. 21.

Elschnig, A. Position of the Source of Light in Primary Localization of Cataract. Medizin. Klin., 1917, No. 19. Centralb. f. prakt. Augenh., 1919, v. 43, p. 25.

Polliot. Stereoscopic Test. Ann. d'Ocul., v. 156, p. 374.

Roche, C. Testing Visual Acuity and Simulators. Caduceé, v. 19, pp. 6-8.

Tests of Visual Acuity. Brit. Jour. Ophth., v. 3, pp. 366-368.

West, L. N. The Eye as an Aid in Diagnosis and Localization of Intracranial Lesions. Charlotte Med. Jour., v. 80, pp. 47-52.

THERAPEUTICS.

Guibert. Subconjunctival Injections of Cow's Milk. Clin. Opht., v. 23, pp. 326-328.

Terrien, F., and Ledoux-Lebard, R. Radium and X-rays in Ophthalmology. Ann. d'Ocul., v. 156, pp. 364-368.

Terson. Chloroform Iodid in Ocular Therapeutics. Ann. d'Ocul., v. 156, pp. 328-333.

Repeated Titles. **Domec** (v. 2, p. 371). Arch. of Ophth., v. 48, p. 398. **Terrien** (v. 1, p. 461). Arch. of Ophth., v. 48, p. 391. **Terson** (v. 1, p. 77). Arch. of Ophth., v. 48, p. 397.

OPERATIONS.

Beykowsky. The Protection of Operated Eyes from Light. Wien. med. Woch., 1918, No. 1.

REFRACTION.

Art, G. Frequency of Astigmatism in 11,704 Patients. Samml. wissenschaftl. Arb., v. 27, Langenabza. Abst., Centralb. f. prakt. Augenh., 1919, v. 43, p. 23.

Pauli, W. E., and Pauli, R. Physiologic Optics for Scientists. Jena, 1918. Gustav Fischer, Abst., Zentralb. f. Physiol., v. 33, p. 399.

Risley, S. D. Genesis of the Myopic Eye. Ohio State Med. Jour., v. 15, pp. 467-472.

Sumner, P. Homatropin in Refraction. California State Jour. of Med., v. 17, pp. 296-297.

Wolff, J. Paresis of Accommodation. Arch. of Ophth., v. 48, pp. 369-70.

Repeated Titles. **Rönne.** (v. 2, p. 305.) Ann. d'Ocul., v. 156, p. 446.

OCULAR MOVEMENTS.

Agatston, S. A. Ophthalmoplegia Interna Following Pneumococcus Conjunctivitis. Arch. of Ophth., v. 48, p. 369.

Barbieri, A. Paralysis of the Ocular Muscles. Semana Med. Buenos Aires, v. 25, p. 751.

Benjamins, C. E. Tonic Reflexes in Muscles of Eye. Arch. Neurol. de physiol., 1918, v. 2, pp. 536-544. Neurol. Bulletin, v. 2, p. 556.

Brouwer, B. Clinical Anatomic Investigation of the Oculo-Motor Nucleus. Zeitschr. f. d. ges. Neurol. u. Psychiat., v. 40, pp. 152-189.

Descomps, P., Euziere, J., and Merle, P. Convergence Following Great Excitement. Presse Méd., v. 26, p. 509.

Holzer, W. F. Determination of Deviation in Squint by the Priestley Smith Method with a Modification to Insure Greater Accuracy. (1 ill., Bibl.) Amer. Jour. Ophth., v. 2, pp. 520-522.

Lereboullet, P., and Mouzon, J. Ocular Paralysis with Hereditary Syphilis in Child. Jour. Nerv. and Ment. Dis., v. 50, p. 91. Paris Méd. 1919, p. 20. Abst., Brit. Jour. Child. Dis., v. 16, p. 121.

Lint, Van. New Technic in Advancement for Strabismus. (Dis.) Ann. d'Ocul., v. 156, pp. 373-4.

Majewski, K. Measurement of Nystagmus. Graefe's Arch. f. Ophth., v. 96, p. 140. Abst., Zentralb. f. Physiol., v. 33, p. 345.

Maxwell, E. M. Concomitant Squint in the Practice of the Late Mr. P. W. Maxwell. Part 1. Brit. Jour. Ophth., v. 3, pp. 340-349.

Mills, L. Effects of Faulty Craniospinal Form and Alignment Upon Eyes. Amer. Jour. Ophth., v. 2, pp. 493-499.

Moron Ruiz, J. Advancement of External Rectus Muscle and the Correction of Convergent Strabismus. (3 ill.) Arch. de Oftal. Hisp.-Amer., v. 19, pp. 336-343.

Riley, H. A. Conjugate Deviation with Astereognosis. Arch. of Ophth., v. 48, pp. 340-343, and 371.

Stickney, O. Abducens Paralysis in Acute Suppurative Otitis Media with Mastoiditis. Laryngoscope, v. 29, pp. 395-399.

Uchermann. Abducens Paralysis Following Operation for Acute Mastoiditis. Norsk Mag. for Laegevidensk., v. 80, July, 1919, p. 770.

Repeated Titles. **Aubineau** and **Lenoble.** (v. 1, p. 707.) Arch. of Ophth., v. 48, p. 400. **Cantonnet, A.** (v. 1, p. 219.) Amer. Jour. Ophth., v. 2, p. 540. Arch. of Ophth., v. 48, p. 399. **Elschnig.** (v. 2, p. 306.) Ann. d'Ocul., v. 156, p. 443. **Terrien.** (v. 1, p. 462.) Arch. of Ophth., v. 48, p. 400.

CONJUNCTIVA.

Basterra. Primary Bilateral Tuberculosis of the Conjunctiva. Rev. de Med. y Cirug. pract., v. 121, p. 52.

Blatt, N. New Treatment of Trachoma. Wiener klin. Woch., 1918, No. 25, Abst., Centralb. f. prakt. Augenh., v. 43, 1919, p. 29.

Burga, B. Trachoma in Peru. Cron. Med. Lima, v. 35, pp. 360-366.

Cazaux. Trachoma in Tonkin. Caduceé, Paris, v. 18, p. 94.

Conlon, F. A. Conjunctivitis Due to Food Anaphylaxis. (Bibl.) Amer. Jour. Ophth., v. 2, pp. 486-488.

Derby, G. S. Control of Trachoma Among the Alien Labor Companies of the British and American Expeditionary Forces. (6 ill.) Amer. Jour. Ophth., v. 2, pp. 500-508.

Diamare, V. Gonococcus Ophthalmia. Riforma Med., v. 35, p. 420. Abst., Jour. Amer. Med. Assn., v. 73, p. 373.

Early Treatment of Ophthalmia Neonatorum. Brit. Jour. Ophth., v. 3, p. 365.

Kraft, J. E. L., and **ten Doesschate.** Treatment of Gonorrheal Ophthalmia by Diathermia. Tijdschr. v. Geneesk., July 21, 1917. Abst., Amer. Jour. Ophth., v. 2, p. 541.

Lindner, K. Trachoma. Wiener med. Woch., 1918. No. 1. Abst., Centralb. f. prakt. Augenh., 1919, v. 43, p. 26.

Löwenstein, A. Control of Trachoma in Bosnia-Herzagovinia and Dalmatia. Abst., Centralb. f. prakt. Augenh., 1919, v. 43, p. 27.

McWalter, J. C. 873 Eye Cases in Egypt. Med. Press, v. 108, p. 43.

Meissner, M., and **Klein.** Acute Conjunctivitis from a Prothesis not Removed for Twelve Years. Woch. f. Therap. u. Hyg. d. Auges., v. 22, p. 49.

Adult Blennorrhea. Woch. f. Therap. u. Hyg. d. Auges., v. 22, p. 49.

Initial Sclerosis of the Bulbar Conjunctiva. Woch. f. Therap. u. Hyg. d. Auges., v. 22, p. 49.

Nicola, S. Treatment of Trachoma. España Oftal., v. 4, June, 1919, pp. 205-210.

Rau. Severe Trachoma. Deutsche med. Woch., 1913, No. 45. Abst., Woch. f. Therap. u. Hyg. d. Auges., v. 17, p. 308.

Reitsch, W. The Treatment of Gonorrheal Blennorrhea by Parenteral Injections. (Bibl.) Woch. f. Therap. u. Hyg. d. Auges., v. 22, pp. 93-95.

Santos-Fernandez, J. Stubbornness of Some Cases of Conjunctivitis. Amer. Jour. Ophth., v. 2, pp. 524-526.

Steiner. Etiology and Prophylaxis of Scrofulous Ocular Affections. Ann. d'Ocul., v. 156, p. 228. Abst. Amer. Jour. Med. Sc., v. 158, p. 288.

Strickler, D. A. Typical Phlyctenular Conjunctivitis. (Dis.) Amer. Jour. Ophth., v. 2, p. 526.

Thierry, J. Trachoma in Chile. Rev. Méd. de Chile, v. 47, p. 70. Abst., Jour. Amer. Med. Assn., v. 73, p. 459.

Wolff, L. K. Scrofulous Ophthalmia. Nederl. Tijdschr. v. Geneesk., v. 1, p. 1168. Abst., Jour. Amer. Med. Assn., v. 73, p. 305.

Repeated Titles. **Musy.** (v. 1, p. 541.) Arch. of Ophth., v. 48, p. 404.

CORNEA AND SCLERA.

Augstein. Chemotherapy of Serpent Ulcer of Cornea. Münch. med. Woch., April, 1916, v. 63, p. 530.

Buxton, L. H. Dumb-bell Keratitis. Med. Press., v. 108, p. 28.

Dulaney, O. Keratitis. Jour. Tennessee St. Med. Assn., v. 12, pp. 80-84.

Guibert. Treatment of Corneal Ulcer. Clin. Opht., v. 23, pp. 323-325.

Haab, O. Alphabet Keratitis. (1 pl.) Beitr. zür Augenh., v. 91, pp. 1-25.

Haselberg. Corneal Transplantation. Berl. Ophth. Gesellsch., June, 1914. Woch. f. Therap. u. Hyg. des Auges., v. 17, p. 318.

Laveran, A. Great Frequency of Keratitis in Dogs Inoculated with Trypanosomes. Bull. Soc. Path. Exot., v. 9, pp. 375-379.

Pacheco Luna, R. Ocular Lesions Consecutive to Injections of Antityphoid Vaccine, Keratitis Herpetica Febrilis. (Bibl.) Amer. Jour. Ophth., v. 2, pp. 488-492.

Pardies, T. Optochin Treatment of Serpent Ulcer. Woch. f. Therap. u. Hyg. des Auges., v. 22, pp. 73-76.

Schoen, H. Relation of Parenchymatous Keratitis to Trauma. Beitr. zür Augenh., v. 88, pp. 599-658.

Stilwill, H. R. Staphyloma of Sclera. Amer. Jour. Ophth., v. 2, p. 528.

Verhoeff, F. H. Keratitis Profunda (or Disciformis?) with Microscopic Examination. (2 ill., Bibl.) Southern Med. Jour., v. 12, pp. 409, 415.

Repeated Titles. **Eperon.** (v. 2, p. 550.) Amer. Jour. Med. Sc., v. 158, p. 289. **Gamper.** (v. 2, p. 306.) Ann. d'Ocul., v. 156, p. 444. **Rönne.** (v. 2, p. 468.) Ann. d'Ocul., v. 156, p. 236. **Weill.** (v. 2, p. 468). Ann. d'Ocul., v. 156, p. 234.

ANTERIOR CHAMBER AND PUPIL.

Barraquer, T. Dilating Muscle of Pupil. Plus Ultra, v. 2, p. 85.

Cabannes. Pupil Reflexes to Light. Jour. de Méd. de Bordeaux, v. 90, p. 222.

Löwenstein. Influence of Blood Vessels upon the Aqueous Humor. Woch. f. Therap. u. Hyg. des Auges., v. 17, p. 374.

Rasquin and Dujardin. Argyll-Robertson Sign. Ann. d'Ocul., v. 156, pp. 393-406.

Suchy, S. Pupillary Reaction. Wiener klin. Woch., 1917, No. 21. Abst., Centralb. f. prakt. Augenh., 1919, v. 43, p. 24.

Repeated Titles. **Dujardin and Rasquin.** (v. 2, p. 373.) Amer. Jour. Med. Sc., v. 158, p. 290.

UVEAL TRACT.

Finnoff, W. C. Macular Choroiditis. (Dis.) Amer. Jour. Ophth., v. 2, p. 528.

Libby, G. F. Disseminated Choroiditis. (Dis.) Amer. Jour. Ophth., v. 2, p. 527.

Santos-Fernandez, J. Persistent Membrane of Iris. Arch. de Oft. Hisp.-Amer., v. 19, pp. 334-336.

Piemont, A. Iridocyclitis with Ocular Hypertension (Arsenobenzol.) Ann. d'Ocul., v. 156, pp. 406-410.

Repeated Titles. **Baumeister.** (v. 2, p. 468.) Ann. d'Ocul., v. 156, p. 257. **Coriat and Boulai.** (v. 1, p. 703.) Arch. of Ophth., v. 48, p. 413. **Franke.** (v. 2, p. 307.) Ann. d'Ocul., v. 156, p. 443. **Prélat.** (v. 1, p. 220.) Brit. Jour. Ophth., v. 3, p. 371. **Ramsay.** (v. 1, p. 879.) Amer. Jour. Ophth., v. 2, p. 537.

SYMPATHETIC DISEASE.

Garcia Mansilla. Sympathetic Ophthalmia Cured by Enucleation of the Sympathizing Eye. Rev. de Med. y. Cirug. pract., v. 118, pp. 33-36.

Morax. Sympathetic Ophthalmia after Evisceration. Soc. d'Opht. de Paris, June, 1919. Ann. d'Ocul., v. 156, p. 421.

Ribstein, W. Sympathetic Ophthalmia following Subconjunctival Scleral Rupture. Centralb. f. prakt. Augenh., v. 43, p. 23.

Truc, H. Sympathetic Ophthalmia. (Dis.) Ann. d'Ocul., v. 156, pp. 333-338, 369-370.

GLAUCOMA.

Deutschmann, R. Trauma and Primary Glaucoma. Beitr. zür. Augenh., v. 91, pp. 26-36.

Sclerectomy and Trepanation after Elliot and Genesis of Choked Disc. Beitr. zür. Augenh., v. 89, pp. 659-705.

Köllner, H. Tension in Glaucoma Simplex. Arch. f. Augenh., v. 83, p. 135; Abst., Zentralb. f. Physiol., v. 33, p. 341.

McCaw, J. A. Keratoglobus or Buphthalmos. Amer. Jour. Ophth., v. 2, p. 528.

Orcutt, D. C. Influenza as a Causative Factor in Acute Glaucoma. (Dis.) Amer. Jour. Ophth., v. 2, pp. 533-536.

Rochat, G. F. Increase of Intraocular Pressure by Stimulation of the Sympathetic Nerve in the Rabbit. Arch. Neurol. di Physiol., 1918, v. 2, pp. 545-551. Abst., Neurol. Bulletin, v. 2, p. 514.

Veasey, C. A. Acute Glaucoma. Arch. of Ophth., v. 48, p. 366.

Wieden. Modification of Technic of Iridectomy. España Oftal., v. 4, May, 1919, p. 169.

Repeated Titles. **Gunnufsen.** (v. 2, p. 468.) Ann. d'Ocul., v. 156, p. 235. **Magitot.** (v. 1, p. 158.) Arch. of Ophth., v. 48, p. 409. **Marbaix.** (v. 1, p. 542.) Arch. of Ophth., v. 48, p. 397. **Morax.** (v. 1, p. 542.) Arch. of Ophth., v. 48, p. 409. **Schindhelm.** (v. 2, p. 308.) Ann. d'Ocul., v. 156, p. 444.

CRYSTALLINE LENS.

Castresana, B. Vacuum Extraction of Cataract. Plus-Ultra, v. 2, p. 149.

Cicerale, L. Cortical Blindness from War Wound; Recovery of Vision after Operation. Riforma Med., v. 35, p. 480.

Dor, L. Medical Treatment of Cataract. Clin. Opht., v. 23, pp. 319-323.

Hegner, C. A. Prognosis of Intrabulbar Lens Luxation. (4 ill., Bibl.) Beitr. zür. Augenh., v. 90, pp. 707-770.

Knapp, P. Tardy Formation of Anterior Chamber after Cataract Extraction. Klin. M. f. Augenh., v. 57, p. 85. Abst., Ann. d'Ocul., v. 156, p. 443.

Nagel, C. S. G. Accidental Traumatic Cataract. Calif. State Jour. Med., 1919, v. 17, p. 110.

Rochon-Duvigneaud. Method of Delivering the Lens. Ann. d'Ocul., v. 156, pp. 342-344, 371.

Strickler, D. A. Ectopia Lentis. (Dis.) Amer. Jour. Ophth., v. 2, p. 526.

Tydings, O. Dislocation of Both Lenses. (Dis.) Amer. Jour. Ophth., v. 2, p. 536.

Villard, H. Temporary Paralysis of the Lids in Cataract Operation. (Dis.) (1 ill.) Ann. d'Ocul., v. 156, pp. 352-364, 372.

Weill, G. Cataract Extraction with a Lance Knife. (Dis.) Ann. d'Ocul., v. 156, pp. 338-342, 371.

Zimmermann, C. Fluctuation of Refraction in Developing Cataract. Amer. Jour. Ophth., v. 2, pp. 420-423.

Repeated Titles. **Houwer.** (v. 2, p. 308.) Ann. d'Ocul., v. 156, p. 446. **Roure.** (v. 1, p. 542.) Arch. of Ophth., v. 48, p. 407. **Liégard.** (v. 1, p. 542.) Arch. of Ophth., v. 48, p. 407. **Vogt.** (v. 2, p. 469.) Ann. d'Ocul., v. 156, p. 236.

VITREOUS.

Masuda, T. Vitreous Humor Clouding Following Attacks of Obscure Fever in Kyoto, Japan. Iji-Shimbun, 1917, No. 976. Abst., China Med. Jour., Shanghai, 1918, v. 32, p. 468.

RETINA.

Agatston, S. Congenital Coloboma of the Macula. Arch. of Ophth., v. 48, p. 377.

Bane, W. C. Hemorrhagic Retinitis. Amer. Jour. Ophth., v. 2, p. 528.

Clapp, C. A. Albuminuric Retinitis. Amer. Jour. Ophth., v. 2, p. 537.

Detachment of Retina in Eclampsia and Toxemia of Pregnancy. (10 ill., Bibl.) Amer. Jour. Ophth., v. 2, pp. 474-485.

Danis, M. Hemeralopia on the Belgian Front. Ann. d'Ocul., v. 156, pp. 347-352.

Deutschmann, R. Operative Treatment of Retinal Detachment. Beitr. zür. Augenh., v. 92, pp. 37-75.

Gallemaerts. Cysts of the Retina. (5 ill.) Ann. d'Ocul., v. 156, pp. 319-328.

Histology of Traumatic Chorio-retinitis. Ann. d'Ocul., v. 156, p. 376.

Holm, E. External Exudative Retinitis. Klin. M. f. Augenh., Sept.-Oct., 1917. Abst., Brit. Jour. Ophth., v. 3, p. 383.

Lohman, W. Teaching of Adaptation. Arch. f. Augenh., v. 83, p. 275. Abst. Zentralb. f. Physiol., v. 33, p. 342.

Magitot, A. Adaptation of the Retina and Night Blindness. Paris Méd., v. 26, p. 369-373.

Orcutt, D. C. Embolism of the Central Artery. Amer. Jour. Ophth., v. 2, p. 536.

Uribe-Troncoso, M. Arteriosclerosis and the Eye. Diagnosis of General Disease. (1 ill.) Arch. de Oft. Hisp.-Amer., v. 19, pp. 325-333.

Repeated Titles. **Augstein.** (v. 2, p. 469.) Ann. d'Ocul., v. 156, p. 235. **Dor.** (v. 1, p. 750.) Arch. of Ophth., v. 48, p. 413. **Nechitch.** (v. 2, p. 308.) Arch. of Ophth., v. 48, p. 394. **Salus.** (v. 2, p. 308.) Ann. d'Ocul., v. 156, p. 445.

TOXIC AMBLYOPIAS.

Rightor, H. H. Methyl-Alcohol Blindness. (Dis.) Jour. Arkansas Med. Soc., v. 16, pp. 49-51.

Repeated Titles. **Uhthoff.** (v. 2 p. 469.) Ann. d'Ocul., v. 156, p. 441.

OPTIC NERVE.

Baute, H. Double Partial Atrophy of Optic Nerve with Lesions of Hypophysis. (2 ill., Bibl.) Ann. d'Ocul., v. 156, pp. 381-393.

Behr, C. Optic Atrophy with Hypophyseal Disease. Klin. M. f. Augenh., v. 57, p. 10. Abst. Ann. d'Ocul., v. 156, p. 441.

Ducamp. Optic Atrophy with Hypophyseal Disease. Soc. d'Opht. de Paris, June, 1919. Ann. d'Ocul., v. 156, p. 419.

Jelgersma, G. Double Peripheral Blindness and Atrophy of Medial and Lower Side of Left Occipital and Temporal Lobes. Psychiat. u. Neurol., pp. 346-360, Bl. 1918.

Libby, G. F. Optic Neuritis. Amer. Jour. Ophth., v. 2, p. 527.

Schoenberg, M. J. Ophthalmo-therapeutic Ignorance Regarding Atrophies. Amer. Jour. Ophth., v. 2, pp. 517-519.

Veasey, C. A. Herpes Zoster Complicated by Acute Retrobulbar Neuritis. Arch. of Ophth., v. 48, pp. 364-367.

Repeated Titles. **Behr.** (v. 2, p. 469.) Ann. d'Ocul., v. 156, p. 237.

VISUAL TRACTS AND CENTERS.

Aubaret. Lesions of Optic Tracts in War Wounds. Ann. d'Ocul., v. 156, p. 368.

Beeley, A. L. Mirror Writing. Monograph, Univ. of Utah. Literary Digest, Aug. 16, 1919, p. 24.

Doesschate, G. ten. Visual Disturbances after Wounds in Back of Head. Nederl. Tijdschr. v. Geneesk., April 12, 1919, p. 1183.

Eaton, E. M. Visual Perception of Solid Form. (5 ill.) Brit. Jour. Ophth., v. 3, pp. 349-363.

Filehne, W. Visual Perception of Size on Earth and in Sky. Abst. Zent. f. Physiol., v. 33, p. 402.

Kappers, C. U. A. Neurobiotaxis Demonstrated by Position of Motor Nuclei of Oblongata. Jour. Nerv. and Ment. Dis., v. 50, pp. 1-16.

Marx, E. Limits of Field of Vision. Nederl. Tijdschr. v. Geneesk., v. 2, 1919, pp. 858-863.

Tyson, H. H. Pituitary Tumors. Arch. of Ophth., v. 48, pp. 368-369.

Repeated Titles. **Früchte.** (v. 2, p. 309.) Ann. d'Ocul., v. 156, p. 445. **Lemiere.** (v. 1, p. 542.) Arch. of Ophth., v. 48, p. 394. **Morax, Moreau,** and **Castelain.** (v. 2, p. 309.) Amer. Jour. Ophth., v. 2, p. 539.

COLOR VISION.

Hahn, E. Color Sense of Day Birds, and the Oil Globules of Cones. Zeit. f. Wissenschaft. Zool., v. 116, p. 1. Abst. Zent. f. Physiol., v. 33, p. 401.

Ostwald, W. Color Perimeter. Abst. Zent. f. Physiol., v. 33, p. 343.

Waite, G. M. Color Discrimination in Mud-minnows and Sticklebacks. Jour. Exp. Zool., v. 27, p. 443.

EYEBALL.

Bergmeister. Enucleation at the Front. Wiener med. Woch., 1918, No. 1. Abst. Cent. f. p. Augenh., v. 43, p. 27.

Van Duyse, M. Congenital Malformation of Eyeball. Gand Univ. Diss., 1919.

Repeated Titles. **Lauber** and **Henning.** (v. 2, p. 79.) Ann. d'Ocul., v. 156, p. 442.

LACRIMAL APPARATUS.

Gerard. Hemorrhagic Lacrimal Cyst. Soc. d'Opht. de Paris, June, 1919. Ann. d'Ocul., v. 156, p. 422.

Holmes, C. R. Extirpation of Lacrimal Gland in Epiphora. Arch. of Ophth., v. 48, pp. 323-333, and 374-377.

Loeb, C. Cyst Occupying Region of Lacrimal Sac. (Dis.) Amer. Jour. Ophth., v. 2, p. 537.

Ramon Castroviejo y Nobajas. Microscopic Examination of Lacrimal Concretions. España Oftal., v. 4, May, 1919, pp. 173-185, and June, pp. 193-205.

Wiener, A. Radical Treatment of Epiphora. Arch. of Ophth., v. 48, p. 334.

Würdemann, H. V. Abuse of Canalicotomy in Simple Epiphora. Amer. Jour. Ophth., v. 2, p. 542.

Repeated Titles. **Detzel.** (v. 2, p. 174.) Brit. Jour. Ophth., v. 3, p. 382. **Fischer.** (v. 2, p. 470.) Clin. Opht., v. 23, p. 373. **Hegner.** (v. 2, p. 470.) Ann. d'Ocul., v. 156, p. 233.

LIDS

Bellencontre. Chalazion Following Incorrect Refraction. Clin. Opht., v. 23, p. 328.

Heckel, E. B. Autogenous One-piece Epithelial Grafts for Restoration of Lids. (6 ill.) Arch. of Ophth., v. 48, pp. 311-316.

Marshall, A. Edema of Lids Caused by Ants. Jour. Trop. Med. and Hyg., v. 22, p. 117.

Pockley, F. A. Epicanthus and Congenital Ptosis. (3 ill.) Med. Jour. Australia, June 21, 1919, p. 509.

Poulard. Palpebral Autoplasty. Ann. d'Ocul., v. 156, p. 376.

Rosenheck, C. Blepharoptosis of Psychogenic Origin. (2 ill.) Neurol. Bull., v. 2, pp. 239-242.

Snydacker, E. F. Snydacker's Blepharoplasty in Morax's Clinic. (Dis.) Amer. Jour. Ophth., v. 2, pp. 529-533.

Zamoso, C. Congenital Anomaly of Lids. (2 ill.) Arch. de Oft. Hisp.-Amer., v. 19, p. 344.

Repeated Titles. **Leriche.** (v. 2, p. 551.) New York Med. Jour., v. 110, p. 210.

ORBIT.

Aubaret and Ferrand. Forced Dilatation of Orbital Cavity in Prothesis. (Dis.) Ann. d'Ocul., v. 156, p. 374.

Becco, R. Frontal Mucocele. Semana Med., 1919, v. 26, p. 341. Abst. Surg. Gynecol. and Obst., v. 29, p. 136.

Coulomb. Dilatation of Ocular Cavities in Prothesis. Ann. d'Ocul., v. 156, pp. 344-347.

Deve, F. Hydatid Cyst of Orbit. Compt. rend Soc. de Biol., v. 81, p. 111.

Knox, R. X-Ray Therapy in Exophthalmic Goiter. Lancet, Aug. 2, 1919, p. 185.

Poulard. Inclusion of Solid Sphere in Ocular Cavity. Soc. d'Opht. de Paris, June, 1919. Ann. d'Ocul., v. 156, p. 420.

Senise, T. Orbital Syndrome in War Wounds. Ann. di Neurol., 1919, v. 35, p. 12. Abst. Surg., Gynecol. and Obst., v. 29, p. 150.

Wolff, J. Orbital Abscess. Arch. of Ophth., v. 48, p. 370.

Repeated Titles. **Onfray.** (v. 1, p. 543.) Arch. of Ophth., v. 48, p. 402. **Poulard and Real.** (v. 1, p. 543.) Arch. of Ophth., v. 48, p. 402.

PARASITES.

Barsoum, A. Fly-blown Orbits. Bull. Ophth. Soc., Egypt, 1917, p. 64. Brit. Jour. Ophth., v. 3, p. 379.

Repeated Titles. **Cabaut.** (v. 1, p. 622.) Brit. Jour. Ophth., v. 3, p. 380.

TUMORS.

Alger, E. M. Sarcoma of Lacrimal Gland. Arch. of Ophth., v. 48, p. 372.
Sarcoma of Iris and Ciliary Body. (Dis.) Arch. of Ophth., v. 48, p. 373.

Burrows, A. Report of Work of Manchester and District Radium Institute. (16 ill.) Radium, v. 13, pp. 33-43.

Fage. Primary Sarcoma of Iris. Ann. d'Ocul., v. 156, p. 375.

Feingold, M. Granuloma of Cornea. (1 col. pl., Bibl.) Amer. Jour. Ophth., v. 2, pp. 510,517.

Friedenwald, H. Primary Sarcoma of Iris. (1 ill.) Amer. Jour. Ophth., v. 2, p. 523.

Garcia Mansilla. Sarcoma of Optic Nerve. Rev. Med. y Ciurg. Pract., v. 118, pp. 21-23.

Hall, G. W. Cerebellar Tumor. Neurol. Bull., v. 2, p. 519.

Maghy, C. Bilateral Glioma of Retina in Girl of 20; Second Eye Excised after Interval of 18 years. (1 col. pl.) Brit. Jour. Ophth., v. 3, pp. 337-340.

Pfingst, A. O. Sarcoma of Orbit. (Dis.) Kentucky Med. Jour., v. 17, p. 316.

Thomson, E. S. Orbital Tumor. Arch. of Ophth., v. 48, p. 373.

Wiesner, D. H. Tumor of Macular Region. Arch. of Ophth., v. 48, p. 371.

Repeated Titles. **Cosmettatos.** (v. 1, p. 543.) Arch. of Ophth., v. 48, p. 404. **Hirsch.** (v. 2, p. 310). Ann. d'Ocul., v. 156, p. 445. **Velhagen.** (v. 2, p. 307). Ann. d'Ocul., v. 156, p. 445.

INJURIES.

Bane, W. C. Iridialysis. Amer. Jour. Ophth., v. 2, p. 528.

Beykowsky. Ocular Injuries in Mines. Wien. med. Woch., 1918, No. 1. Abst. Cent. f. p. Augenh., v. 43, p. 28.

Gallemaerts and Henrard. Radiographic Localization of Intraocular Foreign Bodies. Bull. de l'Acad. de Méd. de Belgique, July, 1914. Abst. Ann. d'Ocul., v. 156, pp. 378-380.

Harlan. Recovery of Sight after Injury. Amer. Jour. Ophth., v. 2, p. 573.

Jennings, J. E. Removal of Foreign Bodies from Cornea. (3 ill.) Jour. Missouri State Med. Soc., v. 16, p. 263.

Kagan, A. Subconjunctival Scleral Rupture with Episcleral Pigmentation Following Contusion. Wiener klin. Rund., 1918, No. 34. Cent. f. p. Augenh., v. 43, p. 25.

Meissner, M., and Klein. Spontaneous Expulsion of Piece of Iron Six Years After Injury. Woch. f. Therap. u. Hyg. d. Auges, v. 22, p. 49.

Meller, J. Retention of Injured Eyes. Wiener klin. Woch., 1917, No. 15. Abst. Cent. f. p. Augenh., v. 43, p. 24.

Moskowitz, S. Iridectomy and Conjunctivoplasty in Unusual Trauma. (6 ill.) New York Med. Jour., v. 110, p. 242.

Reitsch, W. Removal of Foreign Bodies from Cornea. Woch. f. Therap. u. Hyg. d. Auges, v. 22, p. 90.

Richter. Easy Extraction of Foreign Bodies from Eye. (1 ill.) Münch. med. Woch., April, 1916, p. 554.

Soria y Escudero. Rare Ocular Injury. España Oftalm. June, 1919, p. 211.

Spalding, J. A. Partial Preservation of Vision after Bullet Injury of Both Orbits. Arch. of Ophth., v. 48, pp. 317-332.

Stanke, V. Injury of Eyes from Air Pressure of Bursting Shells. Wiener med. Woch., 1918, No. 1. Abst. Cent. f. p. Augenh., v. 43, p. 27.

Repeated Titles. **Böhm,.** (v. 2, p. 471). Ann. d'Ocul., v. 156, p. 233. **Duverger.** (v. 1, p. 703). Arch. of Ophth., v. 48, p. 413. **Thomsen.** (v. 2, p. 311). Ann. d'Ocul, v. 156, p. 444.

PATHOLOGY.

Repeated Titles. **Landolt.** (v. 1, p. 464). Arch. of Ophth., v. 48, p. 391.

GENERAL DISEASES.

Campbell, H. Leprosy of Eye. Siamese Red Cross Med. Jour., v. 1, Pt. 3.

Claude, H., and Schaefer, H. Lethargic Encephalitis. Bull. de la Soc. Med. d. Hop., v. 43, p. 521. Abst., Jour. Amer. Med. Assn., v. 73, p. 455.

Cullom, M. M. Ocular Manifestations of Focal Infection. (Dis.) Jour. Tenn. State Med. Assn., v. 12, pp. 84-92.

Dwyer, J. G. Focal Infection of Eye from Intestinal Tract. Arch. of Ophth., v. 48, p. 344.

Epidemic Encephalitis. Med. Jour. Australia, June 21, 1919, p. 513-514.

Etienne, G. Lethargic Encephalitis. Bull. de la Soc. des Hop., v. 43, p. 482. Abst. Jour. Amer. Med. Assn., v. 73, p. 455.

Heiman, H. Post Influenzal Encephalitis. Amer. Jour. Dis. Child., v. 18, pp. 83-87.

Jacob, P., and Labeaume. Compression of Sympathetic Nerve and Oculo-Cardiac Reflex with Goiter. Bull. de la Soc. Méd. des Hop., v. 43, p. 556. Abst. Jour. Amer. Med. Assn., v. 73, p. 370.

Ophthalmologist and Internist. Virginia Med. Mo., v. 45, p. 97.

Scott, D. G. Adenoids, Conjunctivitis and Photophobia. (Dis.) Med. Rec., v. 95, p. 255.

Sluder, G. Headaches and Eye Disorders of Nasal Origin. (115 ill.) C. V. Mosby, St. Louis, Mo.

Repeated Titles. **Lavagna.** (v. 1, p. 752). Arch. of Ophth., v. 48, p. 394.

COMPARATIVE OPHTHALMOLOGY.

Rochon-Duvigneaud. The Eye of the Eagle. (Dis.) Ann. d'Ocul., v. 156, p. 376.

HYGIENE.

Langworthy, H. G. Report of Committee on Conservation of Hearing and Vision. Iowa State Med. Soc. Jour., v. 9, p. 242.

Preventable Injuries to Eye. Modern Med., v. 26, p. 222.

Solares, F. V. Prophylaxis of Blindness. Rev. de Med. y Cirurg. Pract., v. 123, p. 375.

Weiss, K. E. Photometry in Ocular Hygiene. Woch. f. Therap. u. Hyg. d. Auges, v. 22, pp. 85-88.

Repeated Titles. **Coulomb.** (v. 2, p. 312). Arch. of Ophth., v. 48, p. 391.

OPHTHALMIC SOCIOLOGY.

Blindness in Mexico. Jour. Amer. Med. Assn., v. 73, p. 350.

Brieux. Help Due Blinded Soldiers. Reveille, v. 1, pp. 190-197.

Delord. Reeducation of Blind at Chartres. Ann. d'Ocul., v. 156, pp. 410-418.

Foveau de Courmelles. Ocular Reeducation. Paris Méd., v. 28, pp. 259-261.

Experience of Ophthalmologist During 49 Months of Military Service. Woch. f. Therap. u. Hyg. d. Auges, v. 22, pp. 57-60; 69-70; 73-90.

General Medical Council and Ophthalmologists. Med. Press, v. 159, p. 4.

Heflebower, R. C. Delay in Sending Patient to Eye Specialist. (Medico-legal.) Eclectic Med. Jour., v. 79, pp. 434-436.

Hönig, A. Ophthalmology in War. Wiener med. Woch., 1918, No. 1. Abst. Cent. f. p. Augenh., v. 43, p. 29.

Jackson, E. The Atlantic City Meetings. (1 ill.) Amer. Jour. Ophth., v. 2, p. 543.

Eyesight Tests and Northeastern R. R. Strikes. Lancet, July 26, 1919, p. 160.

Organized Medicine vs. Organized Optometry. Texas State Jour. Med., v. 15, p. 113.

Red Cross Institute for Blind. 1918, 11 pp. Baltimore, Md.

Rehabilitation of Blinded Soldiers. New York Med. Jour., v. 110, p. 335.

Rochon-Duvigneaud. Institute of Ocular Physiology. Ann. d'Ocul., v. 156, pp. 313-319.

Repeated Titles. **Axenfeld.** (v. 2, p. 312). Ann. d'Ocul., v. 156, p. 446.

HISTORY AND BIOGRAPHY.

Gebb, H. Repetitions of Ophthalmology. Leipzig, 1918. Abst. Cent. f. p. Augenh., v. 43, p. 12.

Hirschberg, J. History of Ophthalmology. Berlin, 1918. Abst. Cent. f. p. Augenh., v. 43, pp. 13-14.

Whitham. Johns Hopkins' Base Hospital Unit. Amer. Jour. Ophth., v. 2, p. 537.

Oxford Ophthalmological Congress. Brit. Jour. Ophth., v. 3, pp. 368-369. Lancet, July 26, 1919, p. 170.